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December 6, 1923

Engineering News-Record

Chicago Union Station Forms Double-End Terminal

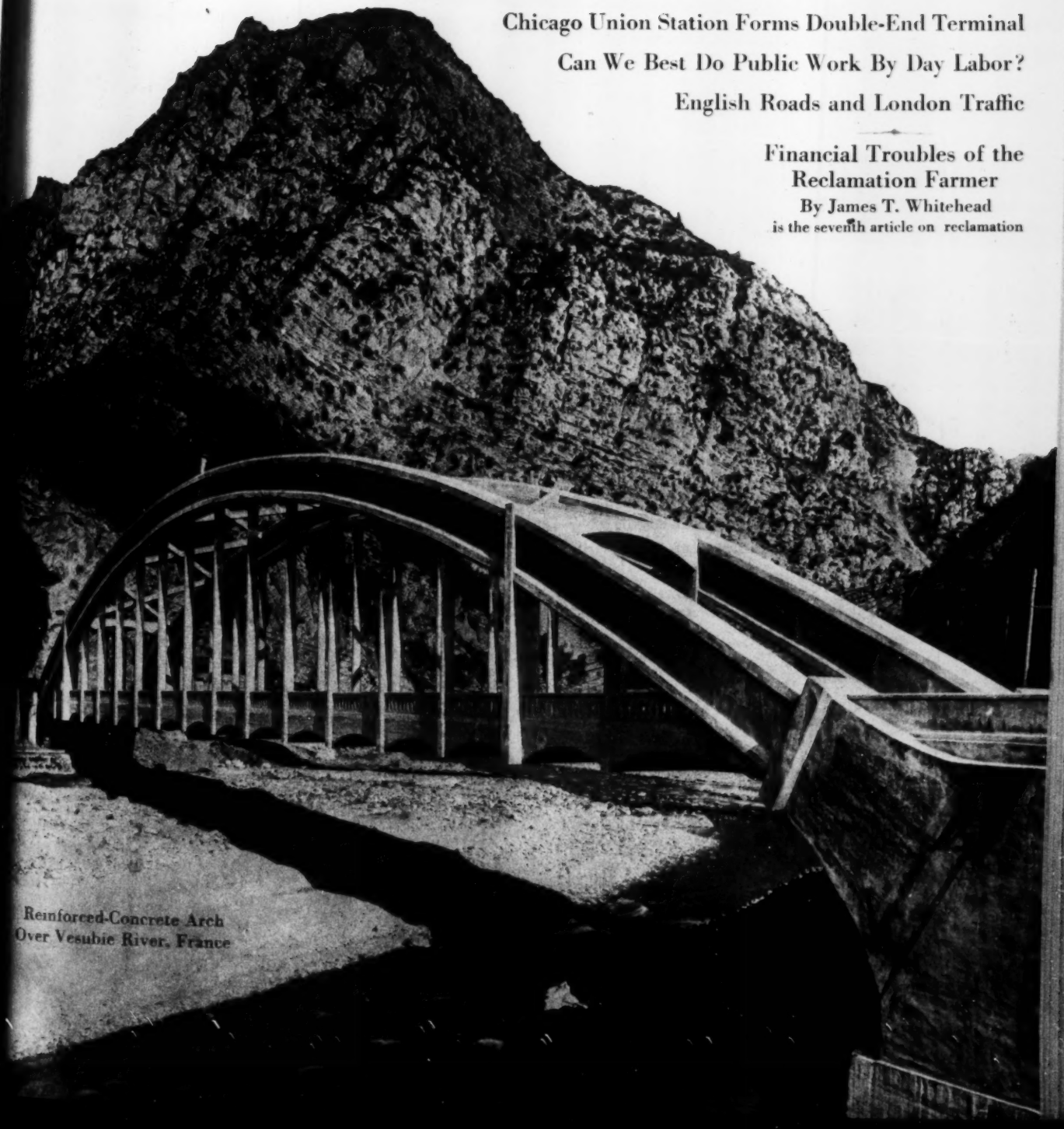
Can We Best Do Public Work By Day Labor?

English Roads and London Traffic

Financial Troubles of the Reclamation Farmer

By James T. Whitehead

is the seventh article on reclamation



Reinforced-Concrete Arch Over Vesubie River, France

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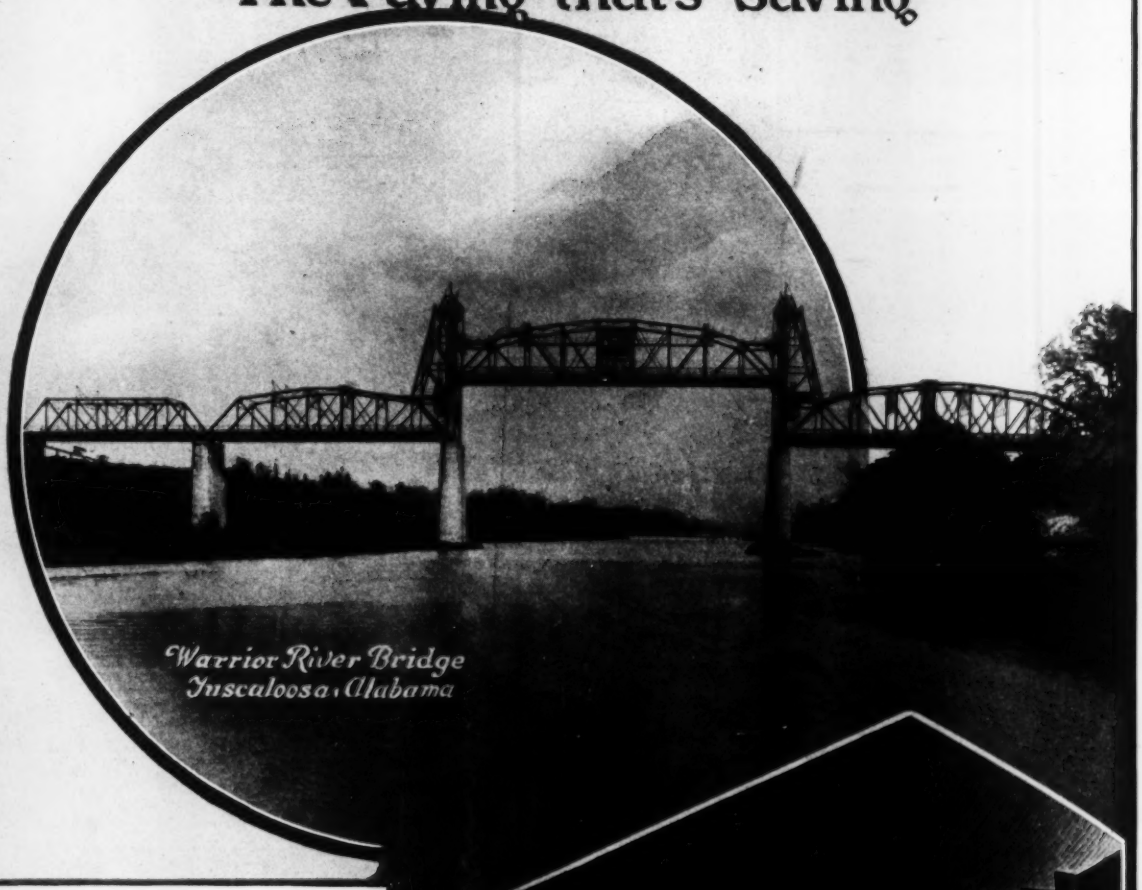
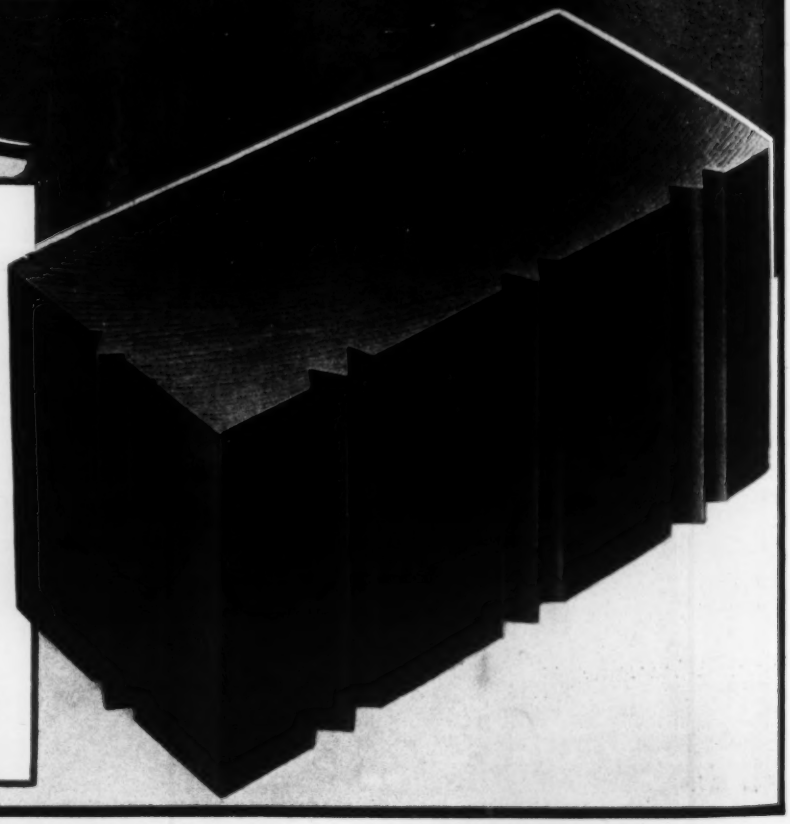


Warrior River Bridge
Tuscaloosa, Alabama



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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

Volume 91 — NEW YORK, DECEMBER 6, 1923 — Number 23

Pity the Poor Editor

THIS is the time of the year when an editor realizes how elaborate is the mechanism of government. In every mail there comes from Washington some new product of the Government Printing Office. Yesterday it was the special press copy of the annual report of the Corps of Engineers (printed on one side of each sheet only, 6½ in. thick and weighing 8 lb. 2½ oz.); today it is the more modest report of the Shipping Board, the not yet to be released message of the President to Congress, three minor bureau reports and a long abstract of what the Chamber of Commerce of the United States thinks Congress should do in the next month or six weeks. Tomorrow several of the Cabinet officers will submit their annual accountings, accompanied in each case by nicely abstracted digests for press consumption, all signed, if not read, by the member of the cabinet whose ostensible words are so recorded. The mere reader is fortunate. Much of this verbosity finds the waste basket and that which survives suffers a diminution which must pain the official authors. Pity the poor editor, who can not so easily avoid his irksome task of finding out just what the government at Washington does to insure that the republic still lives.

Responsibility

THOUGH investors had paid in $282,000, receivers for the Federal Home Building Corp. of St. Louis found that the organization had only $1.92 in cash, a bank balance of $127.12 and a $50 Liberty bond, as liquid assets. Contract holders for whom not even plans had been drawn, and who had been promised residences at a cost lower than any contractor would quote, had paid $123,608. The receivers' audit showed practically no construction work done for the 400 contract holders. It is not often one can reduce to dollars the value of responsibility in contracting; but each of some 400 persons in St. Louis now place that value at $700.

Force Account Again

IS IT best to do public work by day labor? This question is asked in this issue and answered by three experienced engineers. It has frequently been asked and answered in the past. Indeed the question is perennial. Also the answers this time are no more likely to be accepted as final than have the same answers of years gone by. There is little prospect that the situation will change. So long as contractors prosper by doing public work just so long will engineers aspire to save this profit for the public. And so long as political interference exists in the management of public work so long also will engineers be dubious of the chances for its economic conduct by day labor. To reason thus in a circle gets the argument of contract versus day labor construction to no definite end. Argument anyway is futile. Any argument is futile which starts from assumed conditions which the two sides do not agree on. The conditions essential to successful day labor construction as stated by Mr. Holleran in his article in this issue are in the main part asserted not to exist by Mr. Brown. It serves little purpose under such conditions to wrangle about force account and contract construction as a preferable policy for public work. As they stand the three articles in this issue present the situation about as fairly as can be.

Winter Work Costs Less

AS EXPERIENCE with winter construction increases its disciples multiply. Last week at a luncheon meeting of the New York Building Congress both architects and builders stood up and proclaimed the doctrine that not only was winter building practicable but that it cost less than construction in the normal building season of eight months of spring, summer and fall. Some of the evidence presented by the several speakers is given on another page. The winter reduction in prices and the winter increase in the output of workmen make an astounding record. Indeed one must be cautious in accepting the figures at face value. With winter construction universal the various influences which now tend to lower materials prices and to prompt efficiency of labor would be largely modified. It is the dearth of construction in winter which now makes workmen anxious to hold their jobs by high production and that induces the materials producer to cut prices so as to keep his product moving in the normally dull sales season. It also has to be observed that building work offers a greater possibility for winter operations than do public works and more exposed operations generally. But when all allowances are made the elimination of seasonal operations is bound to reduce the cost level of construction. The task is to convince the building public against all the influences of habit and tradition that there need to be no seasons in building. Records of actual operations in winter such as were presented at the Building Congress meeting will do more to accomplish this task than will volumes of general preachment on the evils of industrial waste. The time indeed has come when less talk and more facts are badly needed in the warfare against seasonal construction.

Timely Business Statistics

BUSINESS statistics are rapidly becoming of more than academic interest. There was a time when mass figures on production, consumption, costs and prices were accumulated only by the census office and published many years after their collection. They thus became merely historical references for the professional economist and were of value mainly in assisting him in telling what really happened in the past. Today such figures have a live interest to every forward looking business man, because he is training himself to use them in the study of the immediate past as some indi-

cation of the immediate future. This requires above all that such statistics should be complete and timely. Both of these qualities mark the new venture of the Department of Commerce, known as the "Commerce Yearbook" which has just been published and which is noted on p. 952 of this issue. The current issue covers 1922 and the first months of 1923 and a new edition covering all of the current year is promised for next spring. No one business man is going to be interested in all the statistics the government has here placed before him but every man can find a section which reports some basic data that should guide him in his business.

Tourist Highways Profitable

TOURIST service is given special consideration in highway development in Wisconsin. Blessed with a wealth of waters and woodland which attract the vacationist, the state has been alert to realize, if these profitable visitors are to come and spend money, that the ways of access must be easy and that in this era of the automobile these ways are the public roads. It has found that well-kept, well-marked roads develop tourists. Recently it has undertaken to determine the number, length of visit and expenditure of these motor tourists. From careful traffic counts it finds, according to J. T. Donaghey, engineer of maintenance, Wisconsin Highway Commission, that there are 7,000 cars in and out of the state each way every day from June 10 to September 10. The average stay in the state of these cars is 10.8 days and the average expenditure per car is $11.72 daily. Without going into the calculations in detail, it is noted that Mr. Donaghey computes the season's expenditure in Wisconsin by out-of-state motor tourists to be $100,000,000. He believes that citizens of the state touring by automobile for pleasure spend twice this sum. But keeping to the out-of-state vacation visitor, it is obvious that a hundred million dollar crop created largely by good roads has high significance to state highway officials. It at least offers a good rejoinder to the complaint often heard from the farmer that improved roads are being built for visitors to wear out. As Mr. Donaghey well says: "Even though the tourist traffic is wearing out our highways and causing large annual expenditures for both construction and maintenance it is leaving profits enough along its trail to repair and build the highways much more rapidly than it wears them out."

A Time for Action

IN 1917 A DEADLOCK between a joint committee of the New York City Board of Estimate and the State Public Service Commission on the one hand and the New York Central R.R. on the other was the climax of six years of negotiations looking toward an improvement of the freight line serving the west side of Manhattan Island. It was particularly unfortunate because it followed so closely upon the tentative agreement which had been reached in 1916, when the railroad and the Board of Estimate were co-operating in the study, by which the railroad was to bear all the expense of the grade separation and electrification in exchange for certain parcels of land needed for its enlarged facilities. The deadlock resulted from an attempt to alter this tentative agreement so that the railroad would get the land under a lease revocable in twenty-five years. Naturally, the railroad company considered that it would not be justified in making the expenditure called for by the improved facilities with the possibility of the lease being canceled a few years after the work was completed, and so rejected the new proposal.

In October, 1917, in commenting on the action of the joint committee *Engineering News-Record* said editorially "In six years possibly the commission, having studied the matter from all angles . . . will make the headway the board did in 1916. . . . But no solution will ever come that is enough better than the 1916 plan to compensate for the delay."

Six years have passed and under the spur of a new law which requires the electrification of all railways in New York City, and with a judicial decision which guarantees the railroad its right-of-way, the New York Central has filed the new set of plans for a west side improvement noted in the news section this week. In its chief features this closely follows the 1916 arrangement, but takes advantage of the state grade-crossing law whereby the state and city will each pay 25 per cent of the cost of the grade-crossing separation. In its minor features, the plan is not so elaborate as the 1916 plan and, in view of the state of the city's finances and the need of keeping down unproductive expenditures by the railroads, it is superior to the earlier plan, though that plan could have been put through in 1917 for a considerably less sum.

Opposition to the plan will come from three classes of people; first, those who are opposed to any proposition which is put forward to continue a railroad along the west side of Manhattan Island; second, from those who think that such a railway line should be a joint one, open to all the railroad companies having terminals in New York, and, finally, from residents of the Riverside Drive section who think that the railroad should be entirely hidden from their sight. The first objection is obviously absurd. The west side line is vital to Manhattan Island. The second objection has some argument in its favor, but is almost impossible of attainment without years of litigation, and even then can just as well be put into effect after the new line is built as before it if such an arrangement is found to be practicable. The last argument is, in our opinion, an unreasonable demand for the expenditure of large sums of money in the elimination of a condition which, when the railroad is electrified, will no longer be a serious detriment to the community. There is no reasonable excuse for asking the railroad company to add that much to the cost of delivering goods to Manhattan Island, for that is what such an expenditure must amount to, and if the city has money to spend for such purposes it might better spend it in creating new park spaces down on the East Side.

The estimated cost of the completed project under the 1916 was $50,000,000. The estimated cost of this lesser project is $70,000,000. That much has already been lost by delay. The loss through delay caused by the present method of surface operation in the warehouse district and from inadequate facilities is enormous and must continue until the new facilities are provided. Further delay is unnecessary and costly. All the arguments pro and con have already been accumulated in the voluminous minutes of hearings held in the six years previous to 1917. There seems to be little reason for repeating them; the time is one for action, not for words.

Getting Metering Across

CONTRARY to the generally held view among politicians, the people may want water meters. At least that is what the recent experience of Chicago's officials would go to show. In analyzing the political psychology of the water-waste situation in Chicago the Western Society of Engineers concluded that the word "metering" was one of the big stumbling blocks in getting meters installed, for always the politician asked what meter company wanted to make a sale. In consequence in none of their recommendations did the society refer to anything but "water-waste prevention" nor did any of the city officials in their appeals to the public stress anything but waste prevention and the equity of paying for a measured service. As a result it looks as though the politician's objections were pretty well answered. In the November bills sent out to certain wards which were supposed to be particularly opposed to meters a letter was enclosed explaining how a flat-rate bill of $5.50 would pay for 88,000 gal., or 242 gal. per day, if billed on the measured-service basis. Prior to this a hurried educational campaign in these districts had been made, consisting of talks before improvement associations. By return mail requests began to come in by the hundred, so fast that the appropriation for meters bids fair to be soon exhausted. Aldermen usually know a good thing politically when they see it and unless all signs fail this response of their constituents is going to make them a bit careful about opposing a universal metering ordinance now under consideration. What the majority of the people want and what the aldermen give them will coincide if only the people have the means of letting their wishes be known.

Define Highway Research

CO-ORDINATION of thought is the first task of highway research engineers. Research now means too many things. One man is thinking of pure research to disclose fundamental scientific principles and another is thinking of investigation which discloses the adaptability of a local material for a local road building purpose. Another man confuses routine test analyses with objective investigation. Again one man is searching to find how he may determine and state precisely the problem to be solved and another is seeking the solution first by working all ways from some outcropping factor which has thrust itself into his immediate planning. At the American Research Council meeting two weeks ago of the Advisory Board on Highway Research each of these thoughts was in evidence at some point in the reports and discussions. The fact in no way justifies censure of the work so far of the Advisory Board. It has had a handful throughout its short life of two years in bringing the various highway research agencies into sufficient co-ordination of activities to prevent constant repetition and duplication of experiments. This it has done, perhaps not completely, but in a noteworthy measure. As a result we are now getting to have in America cumulative experimentation in highway and highway transport engineering. Perhaps co-ordination of research thought is harder to attain. The engineering bent of mind is less toward pure research in the sense that we speak of pure science and more toward determination of facts to be used in solving a specific detail in actual design or construction which occupies immediate attention. There is the further obstacle that funds are not often plentiful for extended research merely to define and state a problem to be solved by further research. The engineer has a hard task to explain expenditures for research that cannot be immediately realized on in the way of usable data. But even accepting these conditions research thought can be made more precise and perhaps the task can well be begun by definition by the Advisory Board.

Co-operative Rail Study Begun

WHAT we have long believed to be the most promising plan for improving the quality of rails, to wit, co-operative study of rail troubles by mill men and railway engineers, has just been put into practice. A joint conference group of representatives of the two interests met at Washington recently, on invitation of the Bureau of Standards, and agreed to enter into such study. Railway and mill men have met before this, many times, but usually for the purpose of quarreling over rail specifications, which proved to be fruitless business; but the same parties that could not agree under those conditions will be able to reach a useful result when they are on the same side of the table.

For the present a single factor of unsatisfactory rail performance, the transverse-fissure type of failure, has been taken up for consideration. The first attack is through a statistical study of fissure breaks; this fact has just been announced by the American Railway Association in calling upon its member lines to compile and forward all pertinent data in their possession. In all probability this study will throw new light on the long-disputed question whether fissure failures exhibit furnace-heat influence or track-service influence more strongly. This question is necessarily the starting-point of discussion, as the difficulty of improving rails has been largely due to the opposition of view between those who hold that excessively severe track service causes fissures and those who hold that some elusive metallurgical defect is responsible. The recent contribution to the subject of James E. Howard has enlivened this opposition of view, the more so as railway engineers are accumulating strong evidence pointing toward the predominating influence of "sick" heats of steel upon fissure failures.

So long as opinion differed sharply on a fundamental point of this kind, the chance for writing better rail specifications was zero or negative. But the co-operative effort now begun—and let us hope it will not become prematurely deceased—is almost certain to develop enough definite knowledge to better this condition. It will serve a very direct need of modern railway engineering, moreover, if it succeeds in showing a way by which the new rails of very heavy section (above 100 lb. per yd.) can be given as high a carbon content as wear and strength demand, without introducing increased liability to fissure formation.

Perhaps even at this early stage of the work it may be serviceable to recall that where a question has two sides each defended by strong argument it is usually found that both sides are right. So in the present matter, the full data may show both excessive track service under certain conditions and defective steel in certain lots of metal. In that event the gain from the newly begun study will be only the greater, since it will have a beneficial reaction on both the railway and the steelmaking art.

Two Reinforced-Concrete Bridges in France

Vesubie River Arch Structure and Bowstring Bridge Over Maudit River at Nantes Are Typical Examples of Recent Long-Span Concrete Bridges

By W. L. Scott
Chief Engineer, Considere Constructions, Ltd.,
London, England

TWO BRIDGES of considerable span, one across the River Vesubie and one at Nantes, provide excellent examples of the progress of reinforced-concrete bridge construction in France. Both of these bridges have been constructed to Considere designs and while being similar in elevation, are entirely different in type. The former is an arch bridge, thrusting on mass concrete abutments, and the latter is a bowstring bridge in which the horizontal thrust given by the arched ribs is taken through the ties formed at deck level.

FIG. 1—CONCRETE ARCH ACROSS VESUBIE RIVER

Deformation in the arch ribs of any bridge result from: (1) Compression due to the dead weight of the bridge and superimposed loading; (2) inevitable settlement of the abutments during construction and immediately after completion; (3) shrinkage of concrete during setting and hardening; and (4) atmospheric variations of temperature. It is essential that these factors be taken into consideration in the design of big span bridges, in which the main supporting members are of the arch type.

In the case of the bridge over the River Vesubie, the above factors are principally provided for by introducing temporary hinges at each of the springings and at the crown during construction, and, in addition, by completely severing the deck platform in a transverse direction near one end of the bridge.

In the case of the bowstring girder bridge at Nantes, concrete rocker bearings were provided at one end of the bridge and roller bearings at the opposite end thereby permitting angular as well as longitudinal displacement. It will be appreciated that temperature and shrinkage stresses do not require to be taken into account in the design, since the horizontal ties are affected in a similar manner to the arch ribs and approximately to the same extent.

Vesubie Bridge—The bridge over the River Vesubie (Fig. 1) is 344½ ft. long and with a clear span of 315 ft. is among the largest of its type in the world. The deck platform accommodates a roadway 16½ ft. wide and two footpaths, one on either side, giving a total width between parapets of 24 ft. As will be seen from the illustration, the entire deck platform is suspended from the main arch ribs and with this arrangement no interruption is given to the river when it is in flood.

The temporary staging used in the construction of this work was of the ordinary type in which the weight of the structure was carried on transverse trestles, which carried longitudinal timber trusses, so braced that each vertical suspender was strutted to the transverse trestles.

Temporary Hinges Employed—There is no particular novelty in the design of this structure, with the possible exception of the type of temporary hinge employed. Fig. 2 illustrates this hinge, and the thrust being taken by it when the photograph was taken amounted to 400 tons. These temporary hinges are designed and placed so that they neutralize the bending

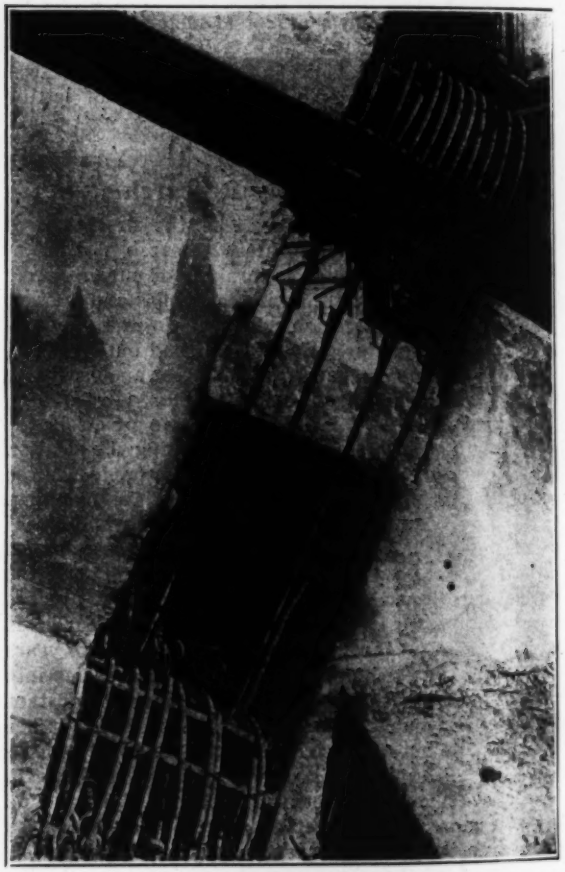


FIG. 2—TEMPORARY HINGE TAKES 400-TON THRUST; VESUBIE RIVER BRIDGE

Hinge is designed to neutralize bending moments due to shrinkage, shortening under load and abutment settlement.

FIG. 3—BOWSTRING GIRDER SPAN AT NANTES

moments due to shrinkage and arch shortening under load, in addition to any elastic settlement of the abutments.

Experience has shown that the stresses due to these latter effects frequently exceed the maximum calculated stresses due to the ordinary arch thrust and moments due to superimposed loading and temperature variations. It would be quite impossible satisfactorily to erect a bridge of this type and span if the flattening of the arches resultant from the above effects were, as is so often the case, ignored.

A certain amount of criticism has been advanced against temporary hinges, to the effect that these cannot properly be regarded as hinges, owing to the resistance given by the main tension reinforcement in the ribs being present and effective in preventing the required distortion. However, such hinges are always designed so as to be sufficiently ductile to compress under load in such a manner that little, if any, tension is ever brought upon the exposed main reinforcement of the rib member. Moreover, the curved main reinforcement is always exposed for a length sufficient to enable it to deform to the very small extent required without distress.

Wind Pressure—The Vesubie bridge is situated in a very exposed position and the question of lateral wind pressure had to be taken into careful consideration. A pressure of 50 lb. per square foot was the figure adopted in the calculations, and this was wholly taken for the central portion of this bridge by the curved ribs, which were suitably provided with lattice bracing so as to enable them to work as a horizontal curved girder. Near both ends of the bridge a heavy frame has been introduced and this transmits the lateral forces to the deck platform, which in turn transmits the total lateral thrust to the abutments in cantilever fashion.

Immediately after completion the bridge was tested by vehicles aggregating 100 tons in weight with a resultant maximum elastic deflection of ⅜ in. The bridge has now been open to traffic for about a year and a recent examination of the structure has shown that there are no cracks of any kind in any part of it. In view of this the bridge can be classed as a truly elastic structure and the various assumptions made in the design of the work thereby justified.

Maudit River Bridge—This bridge, at Nantes, beyond the fact that the deck platform is suspended from the arched ribs, requires entirely different treatment in design from the Vesubie bridge, as a brief consideration of the differences in supporting conditions will make clear. The span of the structure in question is 180 ft. and the rise to the arch ribs one-sixth of this amount, which proved to be the economical ratio. (Fig. 3).

The principal advantages of this type of bridge are clear waterway and simplicity of abutment supports, while a disadvantage may be stated to be the limitations of this type of structure to bridges of reasonably narrow width.

Vertical Suspenders—In the case of the Nantes bridge, the footpaths have been cantilevered. With such an arrangement the bowstring girders can be employed for most cases ordinarily met with. Particular regard has been paid to the design of the vertical suspenders, which are made flexible in the plane of the girder so that they do not offer appreciable resistance to the elastic deflection of the curved ribs. These members also require to be made sufficiently rigid in the

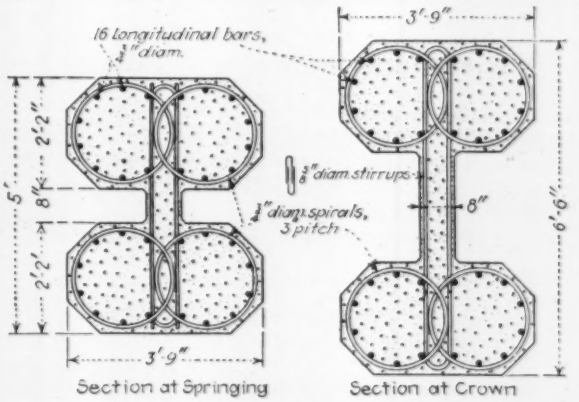


FIG. 4—SECTIONS OF RIB AT SPRINGING AND CROWN; MAUDIT RIVER BRIDGE AT NANTES

transverse direction, so as to transmit the lateral force of the wind coming upon the girders to the deck platform, which acts as a horizontal girder in transmitting the total lateral thrust from the wind to the shore supports.

Until quite recently, some engineers have rigorously opposed the employment of such reinforced-concrete members subjected to pure tension, particularly where these are placed on the inner edge of the pavement, in which position they may be subjected to serious damage from vehicles becoming out of control, but the soundness of design and stability of the structure are borne out by the fact that two or three ties have, at times, been entirely destroyed without any apparent effect on the deck platform.

The curved ribs for the bridge at Nantes are of "H"-section with the upper and lower ribs heavily spiralled. In the design of bowstring girders, the most important point requiring consideration is the connection between the curved ribs and the horizontal ties. It will be appreciated that the entire horizontal thrust from the ribs has to be absorbed into the ties over a relatively short distance and in order that this shall be done satisfactorily, the varying intensities of stress at these connections have been carefully studied and a design formulated whereby these connections can be given the same reserve of strength as obtains in the

remainder of the bridge with the minimum quantities of concrete and reinforcement.

Arch Centering—The temporary staging for the Nantes bridge was built as follows:

An arch truss constructed in two halves was erected and supported on a temporary bracket built on the abutment walls. Suspended from this truss by rods was a horizontal platform at the level of the underside of the horizontal tie. This truss was designed to carry the weight of half of the curved rib and one-half of the horizontal tie. These portions of the girders were then concreted and allowed to take their initial set, after which they were capable of carrying their own weight and the additional weight of the remaining concrete necessary to complete the girder when green. With the girders in position, the deck platform was constructed, the staging for this being supported on the girders themselves.

By this method, the relatively high cost of centering is obviated and the structure is rendered advantageous both from the accommodation and economical standpoints.

Engineering—Profession or Business?

By C. R. Young
Assistant Professor of Structural Engineering, University of Toronto, Toronto, Ont.

Extracts from inaugural address as chairman, Toronto Branch, Engineering Institute of Canada.

THERE is perhaps no question more frequently asked than the time-worn one as to whether engineering is really a profession or not. It has been the ideal of many leading engineers to place engineering on a purely professional basis and to divest it of the characteristics of a business which it has taken on in recent years. One must frankly admit that the results achieved have not been gratifying and that engineering is, if anything, further from the status of a pure profession than it was a generation ago.

If one were asked to define the essentials of a profession, one might say that properly the professional man should make his services available to such clients as care to consult him, and generally for stipulated fees rather than for a salary. Relations with the client should be on the highest possible ethical basis and no measures should be adopted for the securing of commissions which would not be acceptable in type to those prevailing in the professions of law and medicine. One might enumerate as some specific essentials of an engineering profession, the possession of skill and learning by the practitioner, the maintenance of high ethical relations with the client, and the observance of altruistic motives in his relations with the public.

So basic is the idea of learning in a true profession that one often hears mention of the "learned professions." It is inadmissible for the engineering practitioner to be an ignorant or unlettered man. Although the proprietor of a barber shop or of a shoe shining stand may be operating for the benefit of such customers as may care to patronize him, and for a fixed fee, it cannot be maintained that these callings are in the category of professions, in spite of the recent effort to incorporate barbering in British Columbia as a skilled profession. But on the basis of learning as a requisite, however, one might very properly include in the ranks of the "learned professions," the work of the skilled accountant or auditor, who in his field maintains toward clients relations that are comparable with those maintained by the professional engineer.

A basic essential of professional life is that the relations of the professional man to his client should be those of the most exalted trust and of the most circumspect solicitude for the interests of his employer. Telford, for example, while acting as an engineer for several canal companies declined an appointment as engineer to the Liverpool & Manchester Ry., on the ground that it would prejudicially affect the interests of his existing employers. Sir John Fowler was pre-eminently a shareholder's engineer. He restrained his natural impulse to create great and enduring works for monumental purposes and made sure that the interests of the persons who were furnishing the money were primarily observed. The public very properly expects of a professional man a high attitude with regard to public obligations. It expects him not only to further the interests of the people at large, but to prepare himself for the better performance of such service. The appropriate attitude to his profession might very well be put in the words of Francis Bacon, "I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereto."

Smeaton's attitude in this regard would have fully satisfied Bacon. He held that "the abilities of the individual were a debt due to the common stock of public well-being." Having this in mind, he limited his professional employment so that he might devote a certain portion of his time to self-improvement and scientific investigation. He systematically resisted tempting offers to attract him from this settled course.

One must admit that the present status of engineering is that of part profession and part business. The methods of solicitation of new work in engineering are by no means in conformity with those observed by the leaders in the professions of law and medicine. Intensive canvassing and lobbying which characterize the conduct of some engineers in the consulting field at the present time do not well comport with the high ethics of Smeaton and Telford. They are of one and the same type as the methods employed to secure orders for bacon or boots.

The competition that is sometimes introduced by engineers with others who have to all intents and purposes secured a given piece of work is not that characteristic of a pure profession. Thus, when the plans of an engineer have been accepted and tenders are called thereupon, it may be questioned as to whether alternative designs are properly tolerable without the full prior knowledge and consent of the client's engineer. It is, of course, a common procedure for engineering contractors to submit their own designs in competition with those of the engineer in charge of the work, and the practice is so firmly established that it is not likely to be given up. In essence it is an embarrassing procedure. It in effect proclaims that the client's engineer has insufficiently studied the situation and that he has overlooked the merits of another scheme which might prove cheaper than the one which he recommended. Anything which lessens the confidence of the client in his engineer's complete mastery of the subject may well be considered as questionable ethically, but so far have we proceeded from pure ethics in the practice of engineering that this procedure often excites no comment.

Under such conditions it becomes very difficult to frame a comprehensive code of ethics for engineers. When they are operating in part as professional men and in part as men of business it does not seem practicable to establish a purely professional code of ethics that will procure uniform observance by the engineers of the country.

New Large Bridge for England

The Great Western Ry. of England has offered to meet half the cost of a great bridge which it is proposed to build across the Severn and the Wye Rivers at Beachley. The offer is made in conjunction with a tentative estimate that the structure will cost $11,000,000. As the bridge is to be used for vehicular as well as rail traffic, the Ministry of Transport and the local authorities are expected to pay the other half of the cost. The increasing volume of rail traffic between England and South Wales has reached such a point that the tunnel under the Severn is inadequate. The bridge scheme is opposed by the city of Bristol on the ground that it will interfere with navigation.

Through the Reclamation Country

By F. E. Schmitt
Associate Editor, *Engineering News-Record*

THIS is the tenth of the series of letters written by Mr. Schmitt during a journey recently made through the West in which he visited irrigation projects, studied developments, and interviewed builders, operators and settlers, in order to present to our readers the actualities of reclamation as revealed to an unprejudiced investigator.

The series of letters began in the issue of October 4.

El Paso

STATE and local responsibilities toward reclamation force themselves on one's notice chiefly because they are wholly ignored; but nearly every phase of project operation contains some reminder of them.

The federal reclamation enterprise seems to be of little interest to the individual states out here. The states were active in getting appropriations for money to be spent on projects within their own boundaries, but then seem to have lost interest. They are and have been wholly apathetic toward the agricultural communities which the nation has worked hard to establish in their midst. They do nothing to assist these communities in working out their troubles, except for the small item of running experiment or demonstration farms on the projects, usually in co-operation with the federal Department of Agriculture, which began the work. In fact, occasionally a state is directly hostile to reclamation, or at least works against its interests, as the state of Washington, whose speculation in school-land prices delayed the development of these lands for years.

State Indifference—One might think that when the national government builds within a state large public-service works which will greatly increase the state's productive wealth and human resource, it would be the state's most interested care to assure the success of the communities served by these works, through helping them develop. But this opportunity and responsibility do not seem to have penetrated to the legislative mind in the state capitals, or, for that matter, to the public consciousness in the West. As suggested in an earlier letter, the attitude toward the federal projects is that they are Uncle Sam's business, and nobody is going to take care of it for him. The great white father in Washington carrying the helpless reclamation farmer in his awkward bureaucratic arms, and hobbled with red tape, may flounder and stumble as much as he pleases, the state will not lift a hand to help. Why?

More personally than the state, the reclamation community itself is concerned in its own success—the community, rather than the individual farmers. Every merchant or banker in the project town is directly touched in his pocket-book by the success or the failure of the smallest farmer on the project; and so long as this farmer's production is held down by lack of proper farming knowledge or lack of money the merchant and the banker, too, will not prosper as fully as they might. The neighboring farmer, too, is affected, for he will have better markets, better transportation facilities and schools, and better human contacts, if all his fellow settlers are doing well. Thus, the whole community, as a unit, has most to gain (or to lose) by proper promotion (or its neglect)—by agricultural stimulation, live-stock development, creation of marketing, and other co-operative facilities, provision of means for financing, in short all the kinds of work involved in rapid upbuilding of the region. But the community, like the state, has done virtually nothing.

Beginnings of Community Effort—With one or two exceptions, the water users' associations, which deal primarily with contract relations between farmers and government, have done no development work at all. To note an exception: Just north of here, at Las Cruces, New Mexico, headquarters of the upper part of the Rio Grande project, the Elephant Butte Irrigation District is going into promotional work with a good bit of zest, and its office, proudly named "Temple of Agriculture," is meant to become the real agricultural headquarters of the valley. If the district keeps up this purpose it will bring the farmers big dividends. Reclamation farmers generally have vaguely expected the Service to do the boosting and nursing for them; once they learn that the Service cannot do this, or will not, and that they themselves are by all odds the best people to do it, the present problems of reclamation will be pretty well out of the way.

And like Elephant Butte, one or two other associations have begun to proceed more aggressively. Progress is making. If it continues, it will in time arouse state governments to an understanding of their duty.

Another development on this Rio Grande project attracts attention: the Gateway Club here in El Paso, a colonization promoting society organized by local business men, which aims to get desirable settlers for the unfarmed lands of the project. Unless this movement stops short of its best possibilities, it is bound to go on into agricultural and financial development work, and so may become a permanent model for the type of organized activity that every project needs. This El Paso development is specially interesting because the city has been slow to wake up to its place in the scheme of reclamation. One reason why the Rio Grande project did not develop any faster than others, though favored by having a large and rich city in its center, is that El Paso at the start took no more interest in the creation of the new agricultural region around it than it would in the addition of a wing to the local post office. Cattle business and other preoccupations were more important—until now, when other interests have slacked off, agricultural production is the thing that puts jam on the city's bread. Today the business men admit that they were wrong, and that well directed promotion work in the earlier years would have meant greater advance for city man as well as farmer.

Water Users Will Not Operate—Local responsibilities are not only slow to be perceived, but even when perceived they seem to be uncomfortable. On nearly all the projects, the water users will not operate their distribution systems. They complain about government operation, and say they could do the work more cheaply; but they won't. That they are able to operate, and operate well, is shown by experience in the three places where the water users are operating: a section of the Strawberry Valley project (Utah), the north side of the Minidoka project (Idaho), and the Salt River project (Arizona). Still the farmers on the other projects are unwilling to take over the work and relieve the government of a function that does not belong to it,

that it never intended to assume, and that was forced on the Service as an unavoidable necessity.

The motives of this unwillingness appear to be a little mixed. The president of a water users' association told me that government operation assures fairness, and he seemed to apprehend politics or other discrimination if the users operated. Several farmers feared the chance of emergency happenings rather than the risk of unfairness. Another man made it evident that he felt it was to the landholders' interest to have the government hold the bag as long as possible. Grounds for any of these views can not be found. If the users took over operation on all the projects, with only such governmental supervision as would protect the equities, more than half the causes of discord between government and farmer would be eliminated.

Reasons For Local Action—Local action has many advantages, among others the ability to deal more fittingly with local questions and with the requests and complaints of individual farmers. Farmer boards, where they are in action, are much more severely impartial than the Reclamation Service people, in spite of the fact that one of the standing charges against the Service is its lack of human feeling. On one project, where relief applications (under last year's Congressional act authorizing deferment of water charges) were referred to the water users' board, this board turned down many more than the Reclamation Service. In another case, claims of many kinds (for rights-of-way, damages, and the like) were passed on by the water users, and their attitude was quite flinthearted, whereas the Service usually has to go easy rather than hold the individual to strict justice. Dealing with these matters of human relationship is so naturally in the sphere of the local community, made up of neighbors and fellow farmers—a mutual court, as it were—and is so far from being the proper function of the Service, that one wonders why the local people have insisted on sitting back so long.

In discussing how and by whom the vital work of colonizing and developing a reclamation project is to be carried out, a Western engineer said very aptly, "It is impossible to have a strong development policy nationally administered." Settlement and cultivation must be directed from nearer at hand. Except for two factors, it would best be dealt with by the local people themselves, in the opinion of the best informed men out here. These factors are (1) the need for financial strength to support the initial financing of the settlers, and (2) the desirability of adequate breadth of view and adequate resources back of the movement to guarantee progressive development and maintain the value of the enterprise. Half a dozen settlers on a newly opened project are not a sufficiently large community to do any development work except in their own half-dozen backyards; and, as a former irrigation manager said, "The irrigation district system is not applicable to the reclamation of raw desert. Every successful district that we have was preceded by some other attempt at irrigation."

Greater Productivity Needed—Breadth of view and sufficient resources of men and property are required also as a protection against various mischances of development. Irrigation farming, because it is expensive, must be operated for high productivity, and this productivity must be maintained. The present condition (on the authority of agricultural observers on the projects) is that the reclamation projects in particular and irrigation farming in general are not producing as much per acre as they should, by a large margin. It may suit the individual farmer to raise less than half a bale of cotton per acre, but it may be all wrong from the standpoint of the project and of the state. Every sugar company that contracts with farmers for raising beets maintains a skilled corps of field agents who go around among the farmers constantly to help them raise beets the right way and raise enough per acre, and to see that they do so; the companies need high beet production and high sugar content, and know that they will not get it unless they make sure that they get it. There is plenty of opportunity for similar encouragement and agricultural aid to higher productivity on the reclamation projects generally, but the Reclamation Service is not permitted to use its money for such aid work, and the Department of Agriculture does only the little that it can get funds for, which is not much. Besides, some farmers prefer to make a failure their own way rather than a success by advice.

In addition, the danger of decrease in producing power of the soil has to be looked out for, and when necessary fought by whatever means may be required. Some of the irrigation lands are showing signs of decreasing productive power of the ground; and whether this is due to accumulation of salt in the soil from faulty irrigation, or to lack of manuring, or to other causes, it must be studied and combated—which again will usually require a broader view and a more resourceful authority than the local community itself. In fact, the continuing partnership between farmer (or community) and state (or federal government) is a central point of the irrigation business.

To take another aspect of the case, in one of the oldest irrigation states, Utah, fully a fourth of the million and a quarter irrigated acreage has gone out of production through seep, plainly the result of neglect on the part of both individual farmer and local community; this is not reclamation-project land, of course. It is immensely against the interest of the state of Utah (though Utah apparently doesn't know this) to permit the local people to let good agricultural land to go to ruin in this way. The state should have stopped the damage in its early stages, and in any event should take the lead in remedying it. But it failed to do the one, and is not now doing the other. Yet Utah is now angling for many millions of dollars of Reclamation money to put more land under cultivation.

Value of Co-operation—Productivity is only one of several objectives in bettering irrigation and reclamation performance. The right kind of co-operative effort on the part of the local community, the state, and the national government could realize these objectives and at the same time guarantee the equities of the enterprise, but such co-operation does not now exist. The big fighting point of money troubles between reclamation settlers and the Service is closely tied up with productivity. A California man, engaged in orcharding, said that he didn't care how much the water cost, as it was all a question of how much he could get out of his land. An Arizona man emphasized the desirability of higher production on his project by quoting a business epigram, "To hell with the expense account so long as we get the business." In contrast, when

one project is found to be running virtually as a single-crop project, 80 per cent of its production being alfalfa, one is not surprised this project has money troubles.

On that particular project, community action to bring about higher grade farming, chiefly by diversification of crops and planting of high-value specialty crops, has at last gotten a start. In the same way, another project that has had serious money troubles has within the last year developed some energetic community action toward increasing the amount of dairying; bankers and business men in the town have organized for the purchase of high-grade dairy cattle in order to stimulate dairy farming. All such local efforts may in time do away with light-weight farming, planned to give the farmer plenty of time for automobile touring in the best season, much of which is found on some of the projects. "Agricultural aid and enforcing the farmer's financial responsibility are necessary," as one man put it, who in the combined position of farmer, banker and water users' official has wrestled with the project-farmer problem in many campaigns.

Although the states have not taken up their share of the reclamation project burden, they have interested themselves actively in irrigation along another line, within the past few years. They are trying to make irrigation securities attractive to private investors by various devices which purport to give state backing to private irrigation. This matter, however, ties up closely with other aspects of future irrigation and reclamation developments.

Self-Supporting Reinforcement for Concrete Floor

I-Beams With Flanges Slit and Bent to Provide Integral Shear Members Carry Steel Forms—Rods and Wire Mesh

A SELF-SUPPORTING steel reinforcement composed of special I-beams in a framing which also serves to carry steel formwork of special design and thus minimizes the amount of falsework, is a structural feature of the reinforced-concrete floor framing in the Sir Walter Hotel, built recently at Raleigh, N. C. A typical panel is shown in Fig. 1, and a typical floor section in Fig. 2.

In this new type of floor framing, the reinforcement of girders and joists consists of steel I-beams which have the top flanges sheared or slit and the resulting

FIG. 1—I-BEAMS WITH INTEGRAL SHEAR MEMBERS FORM REINFORCEMENT FOR CONCRETE

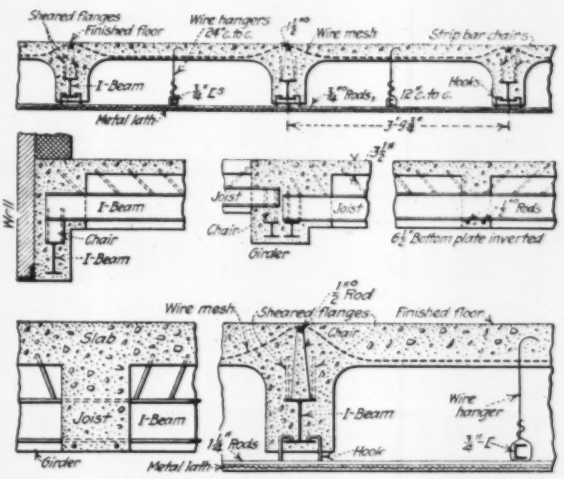


FIG. 2—FLOOR CONSTRUCTION OF SIR WALTER HOTEL

strips bent upward so as to form rigidly connected diagonals or shear members extending into the concrete of the upper part of the girders and joists and into the floor slabs. Where the sheared I-beams rest on similar beams they are fastened together by clips over the flanges. Where the beams pass above supporting I-beams they are bolted to chairs which rest on the lower beams and are clipped to their top flanges. Butt joints in lines of sheared I-beams, such as in joists over girders and in girders over columns, are spliced in the web by flat plates and bolts.

Additional reinforcement is provided in some cases by rib bars bent in the usual way, the bars resting on small blocks or separators on the lower flanges of the I-beams and having their ends bent so as to lie in the concrete slab. Wire mesh laid in the floor slab is raised to the top over the joists, where it is held by ½-in. rods and the diagonal strips of the I-beam flanges. For convenience of transportation, the I-beams are shipped with the shear members raised only slightly above the flanges, as shown in Fig. 3. A special tool is used on the work to raise these members to a uniform angle of 45 deg.

Hooks attached to the bottom flanges of the I-beams carry flat steel forms with edges turned up to catch the hook on a Z-section plate. The lower lip of the Z-plate carries the lower edge of a steel form of inverted trough section. These forms are removed after the concrete has set, so that they can be used several times. The hooks remain permanently and serve to carry rods to which is wired the expanded metal for a suspended ceiling beneath the joists. To prevent sag of the rods they are attached to a ¾-in. channel placed midway between the joists and supported by a hanger wire attached to the steel mesh embedded in the concrete floor slab.

The steel beams are strong enough to carry the dead load of the floor. It is stated that this high carrying capacity not only gives added strength to the reinforced-concrete structure, but also enables the slab forms to be removed in a comparatively short time, thus saving expense and time in erection. Further, since the I-beam framing supports the forms, it can be erected for two or three floors at a time. In the Sir Walter Hotel this type of construction is said to have permitted the use of longer floor spans (35 ft. 2 in.) than

would have been practicable with ordinary reinforced concrete construction, so that one row of interior columns was eliminated and the cost of the building reduced correspondingly.

This type of framing is claimed to combine essential advantages of both reinforced concrete and structural steel construction. It has the former's economy in steel and the latter's self-supporting property, while it eliminates much of the expense and inconvenience of formwork for concrete and the weight and expense of structural steel construction. As a rule the only timber support for the forms consists of a post at the mid-span of each beam, or two posts in spans of over 32 ft. In this way the usual forest of timber falsework is eliminated and the floor space is largely available for storing materials and carrying on the work of the various building trades.

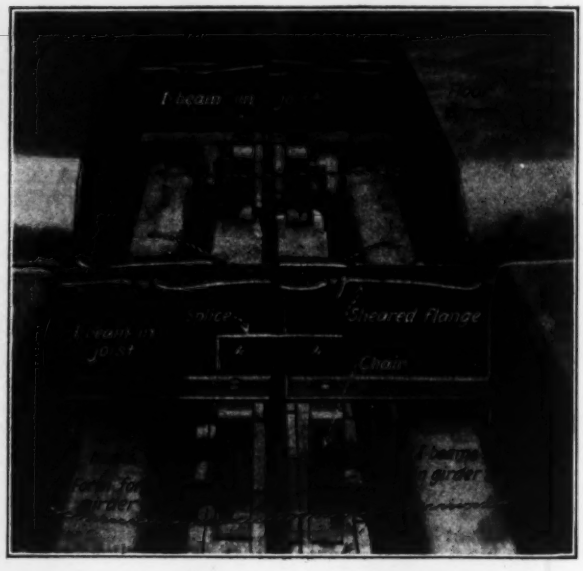


FIG. 3—I-BEAMS AND FORMS IN PLACE FOR GIRDER, JOIST AND SLAB

The Sir Walter Hotel is a ten-story structure, 105 x 140 ft. in plan, of reinforced concrete throughout and having a brick and stone facing. The typical floor panels are about 17 x 18 ft. with joists spaced alternately 4 ft. and 5 ft. c. to c. For the shorter spans there are 4-in. I-beams topped with 6 in. of concrete including a 2½-in. floor slab. For longer spans there are 8-in. I-beams with 10-in. concrete including a 3½-in. slab. Live-loads for floors are 100 and 150 lb. on the first floor, 100 lb. for the second, and 50 lb. for all upper floors.

This new floor system with sheared I-beams was designed by the Truscon Steel Co., Youngstown, Ohio, and was built by the C. V. York Construction Co., which had the general contract for the Sir Walter Hotel. The architect was James Salter, Raleigh, N. C.

Agitate Tennessee-Tombigbee Canal

Interests at Mobile, Ala., are agitating a connection between the Tennessee and Tombigbee Rivers. While their headwaters are separated by only 25 miles, a lock canal would be necessary to carry the waterway over a range of hills. As the waterway would parallel the Mississippi River, some difficulty may be experienced in financing so expensive a development.

Moving Platforms, an Untried Form of Rapid Transit

Large Capacity at Low Operating Costs—Simple Equipment—Eliminates Congestion—Low Train Resistance

A PRACTICAL demonstration of a much-discussed method of rapid transit, the moving platform, is now being made in Jersey City, N. J. This demonstration section is made up of a loop 200 ft. long and 100 ft. wide in its outside dimensions, consisting of three continuous parallel platform loops, operating at 3, 6, and 9 m.p.h., respectively, and one inner stationary loop. Each platform is about 1 in. higher than the adjoining inner platform and overlaps it sufficiently to afford protection on the curve. Each of the moving platforms is made up of a series of small trucks 8 ft. long with circular ends, exactly fitting into each other. These trucks are supported at one end by two independent wheels with ball bearings and connected at the other end to the preceding truck by a universal coupling. The fixed platform and the two inner slow moving platforms are about 30 in. wide and have no seats as they are intended primarily for people getting on and off the fast moving platform, which is about 60 in. wide and provided with two-passenger seats at 32 in. intervals. Most of the platforms are floored with wood, but there are a few sections floored with such material as diamond safety tread and compressed sheet metal covered with anti-slip mastic.

Tests of this equipment made by the Electrical Testing Laboratories of New York on a track section consisting of 73 per cent curves indicate that such a three-stage moving platform would require 150 hp. per mile to operate it. This figure should be considerably less on sections of straight track.

Two methods of propulsion are used for demonstration purposes. The 3- and 6-mile platforms are driven by racks and pinions, the racks mounted on the underside of the platform as independent sections for operation around the curves, but so set that they form a continuous rack when passing over the motor-driven pinions placed on the tangents. The pinions would be spaced from 1,000 to 1,500 ft. apart on large installations. The 9-mile platform is propelled by elements of an induction motor, the secondary or rotating element,

FIG. 1—THREE MOVING PLATFORMS SHOWING ARRANGEMENT OF TRUCKS

made in straight 8-ft. sections clamped to the underside of the cars, forms a continuous secondary, and the stationary or primary element of the motor is made in sections 5 ft. long placed between the rails in groups about 140 ft. apart, with an air gap of $\frac{7}{8}$ in. between the primary and secondary elements. The motor elements are supplied with three-phase alternating current with a frequency of 37½ cycles per second. If the 3- and 6-mile platforms were driven by the same means, the frequency would be reduced to 12½ and 25 cycles respectively.

From the point of view of maintenance, this arrangement has the advantage of few moving parts to get out of order, no concentrated loads or high wear, and few expensive parts. It also has the advantage that as the traction is not developed through contact of the wheels upon the rails, the rails can be kept greased to reduce friction on curves. In the matter of power consumption, such a system has an advantage over independent train units in that there is no power lost in stopping and starting, the platform being always in motion with the passengers walking on and off at the stations by means of the slow-moving platforms. The rolling stock weighs 350 lb. per seated passenger as compared with 1,500 lb. in subway trains. Another advantage claimed for the moving platform as against subway is that as it only requires a clear space 12 ft. wide and 9 ft. high for a platform moving in one direction such a platform system could be put in the space now occupied by sidewalk vaults in city streets. Such a system could have entrances or exits at any convenient points; either directly into the buildings or by stairways to the streets, as it is possible for people to leave the fast moving platform at any point by means of the two slower moving platforms. Another advantage claimed for this type of transit is that should the main fast moving platform be disabled, the two slower moving platforms would still be in operation, and it would be possible for people to use them at the slower speed, and also that in case of some very unusual accident stopping all three platforms, they still would present a well lighted walk, which the people could use to the nearest exit or to continue their journey on foot.

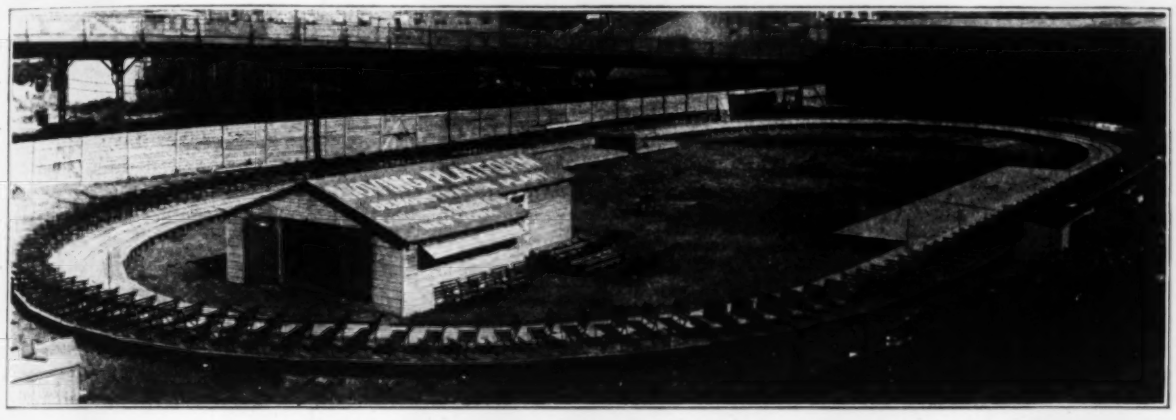


FIG. 2—DEMONSTRATION PLANT OF MOVING PLATFORM SYSTEM
Showing inner fixed platform, two narrow slow moving platforms, and wide fast moving platform on the outside.

FIG. 3—SECTION OF HIGH SPEED PLATFORMS SHOWING ONE METHOD OF PROPULSION
Showing the secondary or rotating element of the induction motor on the underside of the car body and the primary element in its fixed position between rails.

In the matter of passenger capacity, the seated capacity of the 9-mile an hour platform is 35,640 passengers per hour, which is 50 per cent in excess of the seated capacity of the combined local and express services of the New York subways. With the standing room occupied on the fast platform, this capacity can be more than doubled. In addition, at the times of peak loads, passengers could also use the 6-mile an hour platform. As the platforms are always in motion, there should be no crowding at the loading platforms, as people can walk on as fast as they reach the moving platforms.

U. S. Urged to Improve Flushing Creek

The Board of Engineers for Rivers and Harbors is being importuned by interests in the Queens area of New York City to improve Flushing Creek with the idea of providing industrial sites along its course with 12 ft. of water. It has been pointed out to the board that the development of the Queens area is proceeding at a very rapid rate and that the development proposed would insure the erection of plants in what now is an undeveloped area. The board has expressed no opinion in this particular case, but its general policy is to develop the mouth of such a waterway and leave the development from that point on to local interests. An example of that policy is the Buffalo River.

Federal Land Reclamation: A National Problem

7. Financial Troubles of the Reclamation Farmer and How They May Be Relieved

By JAMES T. WHITEHEAD

President of the North Platte Valley Water Users' Association, and President of the Mitchell State Bank, Mitchell, Neb.

The Seventh of a Series of Articles on the History and Performance of the Great Government Adventure in Irrigation of the Arid Lands of the West.

RECLAMATION of arid lands by the national government is a success so far as the engineering features are concerned. There have been no failures of reservoirs to hold water, canals to carry water, nor dams to divert it into reservoirs or canals, except possibly in very unimportant cases. The increased production of foodstuff and the increased demand for manufactured goods is unquestioned. But there are two features of the problem, other than that of engineering, that are of vast importance and it may be seriously questioned whether as regards these a success has been achieved. They are, *first*, the making of happy and prosperous homes, and *second*, return of the money advanced by the government. The solution of the second of these problems depends on the solution of the first, for the water users will pay the government as fast as they can, and the more prosperous they are the sooner will the fund advanced be returned. Under such conditions the whole matter rests on the question of making prosperous homes on the various projects.

When the Reclamation Act was passed no provision was made for any kind of selection of landowners or entrymen. The only requirement was, in the case of privately owned lands, any kind of a deal that looked to the original owner like a chance to get the purchase price from the buyer, and in the case of entrymen on government lands, a $14 filing fee for the right to a homestead. The result was that the projects were settled by people of all kinds of ability, some good, some average, and others very indifferent. Under such a scheme of settlement it was inevitable that a considerable number of the settlers would not be sufficiently successful to keep themselves out of debt and make the required payments out of their farming operations, their only source of income.

Lack of Initial Capital—To operate a farm under irrigation requires a considerable amount of capital, which the entryman was not required to have and which in many cases he did not have. Any business that is under-capitalized is seriously handicapped; and this is as true of the farming business as of any other. To get sufficient capital to operate at all, the entryman had to borrow, and as he usually had only an entry on land whose title remained in the government he was obliged to borrow on short time and at a high rate of interest, giving such chattel security as he had. Generally this security included the prospective crop. The land being unimproved, it was necessary that the entryman build himself a house in which to live, the barn and other buildings, as well as put the land in shape to raise a crop. Debts were sure to accumulate which it would be difficult to meet.

Generally the land does not produce well enough to pay until the soil is built up by the application of barnyard fertilizer or by the introduction of some legume crop that will add to its fertility. This takes time. When prices for farm products were at the peak and the payments to the government were low, the payments were for the most part made, but unfortunately the slump in farm prices came about the time the payments to the government had reached a high rate per acre, and delinquencies began to accumulate together with the penalties for non-payment. The penalty for failure to pay when due is one per cent per month. With payments due on money borrowed at a high rate of interest, with water payments to be made, under heavy penalties for failure to make them, the land seeded to alfalfa was plowed up and planted to crops which it was hoped would produce enough to meet payments required without regard to the building up of the soil for future crops.

As a result, the crops raised even on the good land were raised at a loss, and the farm was less fertile for the next year's crops. Depletion of the soil fertility was the result of endeavoring to make payments that could not be made from the crops raised, if due regard was given to the future prosperity of the farmer. The payments to the government and payments to other creditors could not be made and of course were not made. But for the ever-present hopefulness of the average farmer, the outlook would be discouraging, and it is not encouraging to any but the most courageous.

Deflation Effects—Agriculturalists have passed (or are passing) through one of the most depressing times in their experience. So much has been said about the deflation of the farmer that it is not necessary to repeat it, except to say that it was real and effective. Everything he had was deflated, except what he owed. Farm labor continues to be high-priced and inefficient, the cost of farm machinery is at the highest point, and the things that the farmer has to buy are at peak prices. This is a condition that all farmers generally have had to meet in all parts of the country, where irrigation is practiced as well as where it is not—in Iowa and in Idaho, in Michigan and in Missouri.

With prices of farm products far out of line with the prices of other things for so long a time, agriculture has been and is hard pressed. The farmers on government projects have had to meet all the discouraging conditions that have seemed so difficult to farmers generally where irrigation is not practiced, and in addition have been expected not only to take care of the obligations that are incident to farming, as all must do, but in addition to make cash payments to the government besides. This they could not do, and so came the demand that some respite be given them until it is humanly possible to make these payments.

Business Management the Way Out—Is the future of these projects hopeless? Has it been a mistake for the government to build these great irrigation works? One has only to travel over many of them with his eyes

open and see the crops raised in such abundance to be convinced that there must be a way of managing these projects so that they will succeed and the settlers on them become happy and be prosperous home owners and good citizens—real men and women, fathers and mothers of a future generation who will carry on the work of making greater a nation already great.

And what is the way? The same intelligent management, under the direction of men who are competent to manage intelligently, that is practiced by any successful corporation or business of equal size and importance. The Secretary of the Interior is the head of all the reclamation work being done by the government. He is the president and general manager of the corporation, so to speak. If failure results he must take the responsibility. Should he be held responsible and should he take the blame for failure if he does not have the authority to put business methods into practice, as has any other general manager?

But the general manager of a corporation works under the direction of and in conjunction with a board of directors. The board of directors is or should be composed of a limited number of men familiar with and interested in the success of the business. When it is found that some change must be made in the operation of the plant, the general manager can get his board together and the change can be discussed with the single thought of improving the plant or its operation. In the case of the government reclamation projects, Congress seems to be the board of directors. And what a board! More than five hundred members, scattered all over the United States, and composed for the most part of men not at all interested in the working of the plant and with little or no knowledge of its needs or requirements! But the board cannot be changed. It is the Congress and it must continue to be the Congress. Under such management the wisest possible discretion must be given the general manager, and he must be trusted to deal with the problems as he sees they must be dealt with and take the responsibility of making a success of the venture. This authority he does not have under the present laws.

Give The Secretary Power—He can, under the law as it now is, build a project and operate it practically as long as he likes, without requiring any payment to the government for the cost of the project, so long as he does not issue a formal order to commence paying. The formal order to commence paying, called Public Notice, announces the date payments shall commence and the total amount that must be repaid to cover the cost. When this is done, then he is helpless to modify either the time or the terms of payment, or the penalties for failure to pay when due. Congress should so amend the law that authority is given the Secretary of the Interior to suspend the operation of any public notice as applied to any project, part of a project or an individual within any project, when in his opinion such suspension is necessary to make more sure the success of such project, part of a project or individual settler.

Suspensions of payments should not be granted, nor would they be likely to be granted, for the purpose of extending the time for repayment, but only for the purpose of making it possible to pay more surely, and finally more quickly. The present law is rigid as to amount of annual payments and the time for making them. High-cost projects, even if crop returns are low, must make repayment as fast as the more favorably situated projects where costs are lower and crop returns greater.

Repayment Based on Crops—Terms of repayment should be such as can be met by the ordinary individual who uses due diligence and is otherwise qualified to succeed under normal conditions, and then he should be required to make his payments. If disaster or other unusual conditions should prevail against an individual or group of individuals, it is useless to insist on the impossible being done; some measure of relief should be provided, and it should not be necessary to ask that Congress pass special laws to cover such cases as they come up. It would seem wise for the terms of repayment to be based on the average returns per acre on the different projects or units of a project. Payments based on a percentage of the gross returns from the farm could be met, with the possible exception of individual cases where some unusual conditions prevail, such as complete loss by hail or some crop disease that might ruin a crop. Such unusual conditions could be determined easily, and, where no such conditions exist, payment should be insisted upon and no leniency exercised.

Under such a plan payments would be made as fast as it is possible for them to be made under any kind of plan, for the reason that they cannot be made unless it is possible for the farmers to make them, no matter what the terms may be under the law. It would do away with the periodical requests to Congress for deferment of charges, make it possible to pay, and give encouragement to those who have to do the paying, for they would know that they could, with reasonable industry, pay as much as they would be required to pay.

Briefly summed up, the Secretary of the Interior should have the power to suspend any public notice and the terms of payment should be based on the returns from the farms. Such a plan is businesslike, is workable, and should be tried out. Under it reclamation by the government can succeed, and it will be shown that it was not a mistake on the part of the government to use its funds for the purpose of building homes where none existed before.

Repairing a Lift Span Bridge

THE counterweight cables of the Halsted St. lift bridge in Chicago were renewed in 1922 after being in service 28 years. F. H. Avery, engineer of bridge maintenance, in the latest annual report of the city engineer makes the following reference to the work:

The cables were in good condition, except at the lower end where they were fastened to the top chord of the span At this point they pass through a long clamp and around a pin. Upon removal, the portion passing around the pin was found to be in a dangerous condition with about one-half of the strands broken, the ends of these strands being corroded until they were as sharp as needles.

The work was done without interrupting traffic, the span being closed to river traffic for the time necessary to change two cables each on two diagonally opposite corners. This change at first took 10 days, but this time was reduced finally to 4 days. Sixteen cables were changed in all and work continued in zero weather, accompanied by high winds, which speaks well for the mechanics. This winter work was made possible by building shelters for the men at the tops of the towers. During the periods the span was closed to navigation, work was carried on continuously with two 12-hour shifts, which, of course, increased the cost ($22,062.19) of the work.

English Roads and London Traffic

By Paul Wooton
Washington Correspondent, *Engineering News-Record*

The material for this article was gathered by Mr. Wooton while on a trip through England and France to study recent developments in highway construction and traffic regulation.

UNEMPLOYMENT and the urgency of the need to effect economies in transportation are the two outstanding influences which are stimulating highway activities in the British Isles. Were it not for these compelling influences, road work certainly would languish because there is much popular clamor against such expenditures when the rate of taxation already is very high.

Road work is proving to be one of the most effective media in providing employment, since more unskilled and inexperienced labor can be used than in many activities. Some contend that costs are being carried to a prohibitive level and the quality of the work impaired by the use of many inexperienced and even physically defective men, but those in charge of the work declare that the laborers are unusually willing to do the best work of which they are capable and they have figures to show that the average progress of the work compares favorably with that of other years.

Scarcely second in importance in stimulating road improvement is the need for cheaper transport. For more than two years a considerable percentage of Great Britain's manufacturing capacity has been idle. In many instances a small reduction in production costs would have made it possible to compete, or in the case of an operating concern, would have increased profit, and the volume of production. The cost of inland transportation is very high. Even where good roads exist, there has been such congestion as to offset the advantage. The far-seeing men directing public policies—among whom may be numbered Stanley Baldwin, the premier—have insisted that traffic conditions must be improved as a necessary step in the revival of industry.

Constructing New Routes—Col. C. H. Bressey, the chief engineer of the Roads Department of the Ministry of Transport, is directing a bold policy of blazing entirely new routes rather than trying to widen existing thoroughfares in cities and towns. This policy has been carried out in enough instances, Col. Bressey assured the writer, to demonstrate its practicability. In doing this it has been necessary to overcome strenuous objections from some of the property owners and others who fear loss of importance to existing avenues of traffic. While property owners are inclined to be very insistent that their particular roadway be improved so as to carry additional traffic, they frequently are not disposed to be generous in their ideas of the worth of that portion of their property necessary to the widening of the thoroughfare. In that connection, however, it was stated at the Ministry of Transport that in many cases the enhancement of values through the widening of the street offsets the loss of area. There are so many cases, however, where the additional width desired leaves lots without sufficient depth to be used to advantage, that the practice is tending more and more to roadways around rather than through towns and villages.

Col. Bressey favors building these roads where the maximum of their course can be run through open fields. The owners of country acreage usually are more than willing to give the necessary right-of-way for the road and in many instances will also contribute to the project. This bypass policy, as it is termed in Great Britain, has the additional advantage of preserving landmarks and the ancient appearance of places—an aspect of the situation to which much importance is attached in the British Isles. All the trouble and expense of conducting construction activities among water mains, street-car tracks and wire conduits are avoided, as is the interference to traffic.

In the United Kingdom, as in the United States, the matter of road location and the question of which road is to be improved results in bitterness of the most intense variety. The problem is the more complicated in Great Britain because of the amount of authority vested in local officials, and because of the very large numbers of such authorities. Greater London, for instance, has 122 local authorities who must be approached and consulted on road matters which affect their jurisdiction. (London proper is confined to an area of 1.4 square miles, having less than 15,000 actual residents, despite the fact that it has a day-time population of more than 2,000,000.)

Negotiations with Local Authorities—One of the reasons for the success which has attended Col. Bressey's administration is said to be the skill with which he has handled these negotiations with local authorities and those pertaining to road location. The secret of whatever success he may have had in that direction is attributed by Col. Bressey to the care which has been used in the selection of the men who have to do with public relations. It is his policy not to put a man in a place requiring broad judgment unless that man has had wide experience. Regardless of the earnestness of the man who has confined his work to his own village or city, Col. Bressey believes his results will suffer because of the lack of the broadening influence of wider contacts.

Trouble with Slippery Roads—In addition to the outcry from those whose vision is limited, against the expense of road improvement, Col. Bressey has had to meet from farmers and wagoners an unbelievably insistent objection to slippery roads. The horseshoers have failed to take into account the changes incident to new road surfacing. The shoe most in vogue does not give a sure footing to the horses. As a result, they are prone to fall frequently. The attention paid to this protest by the authorities and the legislators is hard to understand, especially as 95 per cent of the tonnage handled on the roads of England is in motor vehicles. Despite that fact, the horse is much in evidence throughout the Island. In London their number is so great as to constitute a major cause of congestion. Every effort is being put forth to acquaint the owners of horses that slipping can be avoided by proper shoeing.

The spreading of fine gravel on the roadways, on hills and at sharp curves does away with much of the skidding on the part of rubber-tired vehicles. In London steel bins for gravel are erected at frequent intervals. Just as soon as rain begins to fall, the street-cleaning

force scatters this material over the street surfacing. This practice very materially reduces the number of accidents from skidding. While England makes a larger proportional use of concrete, for general purposes, than does any other nation, there is very little traffic carried on concrete surfaces. The use of roads by a large number of steel-tired vehicles leads Col. Bressey to believe that a resilient surfacing should top the concrete. Experience in England also leads to the opinion that solid rubber tires, after short usage, are almost as destructive to a non-resilient surfacing as are steel tires.

London Traffic Problem—London still is temporizing with the traffic problem, but has come face to face with the necessity for improved practice. During the twelve months ended with May, the latest figures available, the number of motor cars in Great Britain increased by 25 per cent. Of that increase commercial vehicles contributed 11 per cent. This rapid growth in the number of motor vehicles, the failure to co-ordinate street repairs, the large use of buses, the disinclination to scrap horse-drawn vehicles and the absence of parallel streets combine to constitute a traffic problem of unusual difficulty.

The number of motor vehicles per capita still is much less than that in the United States. Indications are, however, that the increase in the number of automobiles will continue at an increasing rate. An important contributing factor to the increase is the very material progress which is being made in road improvement. It is very evident, however, that the number of motor cars cannot continue to increase much longer before determined steps must be taken if traffic is moved at even an approximation of an efficient rate of speed. The speed of operation of London buses, in the business district, has decreased from nine to seven miles per hour within the last six months.

No small part of the traffic tie-ups and the congestion on principal thoroughfares, which has come in for world-wide publicity in the press and on the screen, is chargeable to street repairs. This activity is vested in numerous local authorities who are very jealous of their prerogatives. The parochial boundaries date from the time of King Alfred. The wonder is that the 28 separate cities making up greater London get along as well as they do, but it has been evident throughout the past summer that they are not pulling together in the matter of street repairs. In a city with as few alternate routes as has London, there is unusual need for carefully centralized planning as to the streets that are to be torn up simultaneously. Necessity brought about centralization of police authority. It is expected that a similar step must be taken sooner or later in handling the problems arising from the evolution in transport.

Street repairs were carried on this year on a larger scale than usual. It can be said also that the work is being done with greater thoroughness and with a view to a greater degree of permanency than has been undertaken heretofore. This has resulted in withholding from traffic for longer periods the streets under repair.

Wide Arterial Streets—The bold plan of the Ministry of Transport for driving wide arterial streets into the metropolitan area will do much, when complete, to keep through traffic away from the busy streets in the heart of the city, but by the time those roads are ready the number of vehicles probably will have increased to such an extent that much additional relief will have to be furnished.

Resort to one-way streets must remain limited since parallel streets are few. Many think the only wise way to meet the problem is to embark upon an extensive campaign of street widening. That proposal is surrounded by unusual difficulties, due to the enormous value of property along many of the thoroughfares most in need of relief. Even if such an expenditure were justifiable, the widening process would be limited at many points by edifices which would not be altered because of their historic and sentimental value.

The presence on the streets of London of 3,500 motor buses, a number to which fifty new buses are being added weekly, augments the problem materially. These buses make frequent stops. The stops often halt the entire stream of traffic following, because at most points the street is too narrow to accommodate the stream of traffic moving in the opposite direction and still leave room for vehicles to pass so large a unit as an omnibus. While the buses are responsible for some of the congestion, they do not contribute to it nearly so much as do the horse-drawn vehicles. The business situation at this time is such as to preclude any abandonment of horses or horse-drawn vehicles. So long as they can be continued in service it saves their owners the capital outlay necessary to the change to motors. Animal traction is being abandoned in practically every instance, as fast as the existing equipment wears out.

Steam-driven traction engines with trailers ply all London streets, even during the rush hours. While the presence of these large units, with belching smoke stacks, presents a rather formidable appearance in a traffic jam, they are better handled than are many motor trucks and contribute no more than the latter to congestion.

Congestion at Intersections—The handling of traffic at street intersections is not well performed. While an adequate number of policemen are stationed at these points, tangles are frequent and at the rush hours there is no certainty as to the length of time that will be required to negotiate any of the crowded streets.

A glance at the plan of London is all that is necessary to show how few alternate routes can be chosen for traffic. An unusual number of streets are blind. A thoroughfare starting out to be a parallel street may spread quickly to an unbelievably distant point from the street it may have paralleled for a portion of a block.

Day Labor Tunnel Costs in Chicago

Since 1919 work on the 12-ft. Western Ave. water tunnel has been under way. In the 1922 annual report of the water department just issued excavation progress on 7,977 lin.ft. at the Wood St. shaft is given as 10.81 ft. per 8-hr. shift, at a cost of $55.52 per lineal foot including labor and explosives. Trimming 9,224.6 ft. cost $1.05 per foot. Placing footing walls in 7,730.8 ft. cost $1.65 per lineal foot. Lower figures were obtained at the Sixty-First St. shaft where 9,778 ft. were driven at a cost of $54.06 per foot, 5,327 ft. of footing walls placed for 83c. and trimming 6,957 ft. cost 41c. per foot.

Chicago Union Station Forms Double-End Terminal

Heavy Traffic Served by Two Sets of Stub Tracks on Opposite Sides of Concourse—Low-Roof Trainshed With Raised Skylights—Tracks on Concrete Base—Office Building Utilizes Air Rights

PROMINENT among great modern railway passenger terminals will be the new Chicago Union Station, which is now entering the final stages of its construction and which in size, traffic and facilities will rank with the two great terminals at New York and the one at Washington. Initiated in 1914 and interrupted by war, protracted strikes and industrial and commercial disturbances in addition to railway difficulties, it is now expected to have the new station completed in 1924.

Distinctive features of this new Chicago terminal station are as follows: (1) In spite of its large size it has tracks, concourse and all main station facilities on the same level, instead of having the more usual double-deck arrangement; (2) it is said to be the largest one-level station ever built; (3) it is a double-end terminal,

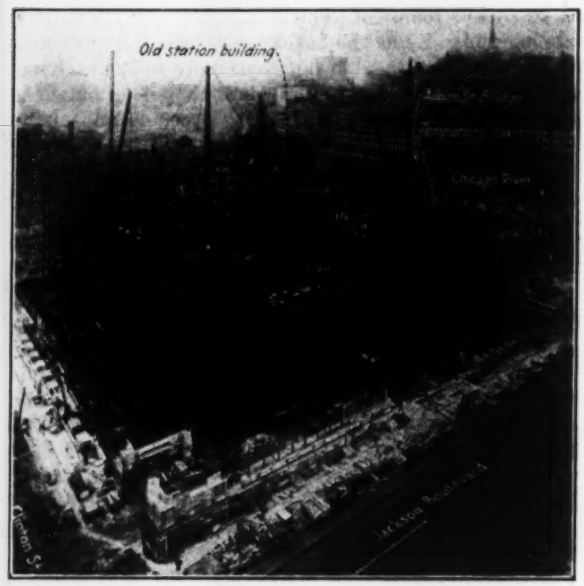


FIG. 1—CONSTRUCTION OF CHICAGO UNION STATION: OCTOBER, 1923

View looking northeast from Jackson Boulevard and Clinton St. Steel frame of headhouse and office building in foreground, with station tracks and platforms at the right and below street level. Beyond the headhouse is the Adams St. bridge over tracks and Chicago river, with the old station building at Adams and Canal Sts.

with two sets of stub tracks abutting on opposite sides of a wide transverse concourse; (4) platform tracks are arranged singly instead of in pairs; (5) passenger and baggage movements are kept separate by assigning alternate platforms for these respective uses; (6) a concrete base under the approach tracks will minimize maintenance work; (7) air rights are utilized by a lofty office building over the headhouse; (8) the trainshed is of the low-roof type but with high longitudinal skylights; (9) compact position-light signals eliminate the usual semaphores; (10) extensive alterations to streets, bridges and public utilities were required; (11) construction work was carried out with little interruption to railway traffic or street traffic.

A view of the station under construction is shown in Fig. 1. The headhouse, surmounted by an office building, occupies an entire city block. Its steel frame is being erected by four large guyed derricks, while stiff-leg derricks place the masonry. Beyond the headhouse is Adams St., with the old station building, a truss bridge over the station tracks and a swing bridge over the river. In Fig. 2 is shown the old steel trainshed in process of removal in August, 1923. This view shows the old through tracks, but in the new station the space shown will be occupied by a concourse between two sets of stub tracks. At the left is the old brick headhouse, but the new headhouse is in a different location. A plan of the new station and adjacent railway structures is shown in Fig. 3.

During the ten years of work and delay in the carrying out of this project there have been changing conditions leading to successive developments of the original plans. The most conspicuous of these developments has been in the design of the headhouse, which is now to be a lofty office building to utilize the air-rights of the site, instead of being a low structure for railway purposes exclusively, as originally planned.

Two special features in addition to the station itself are: (1) Extensive and costly auxiliary works necessitated by the taking of land formerly occupied by various railway and industrial activities; (2) a great amount of reconstruction of streets, bridges, sewers and other adjacent municipal facilities and public service utilities, as indicated in *Engineering News-Record*, Feb. 3 and May 18, 1916, pp. 212 and 948, and March 13, 1919, p. 528. Of no less interest and importance are the numerous construction problems and difficulties encountered in carrying on such complicated work in and around the congested conditions of an outgrown railway terminal in a busy city district.

Traffic Conditions—Daily traffic at this station averages 123 main-line trains and 132 suburban trains in and out, with 14 and 24 trains respectively during the busiest rush hour. The number of passengers averages 25,650 daily, 11,500 of these being main-line and 14,150 being suburban passengers. Furthermore, about 4,750 pieces of baggage are handled daily. For New York, official figures give 133 main-line and 225 suburban trains daily at the Grand Central Station, and 181 and 310 respectively at the Pennsylvania R. R. Station. But the record number of trains appears to be held by the old South Station at Boston, with 344 main-line and 297 suburban trains daily.

Double-End Terminal—A double-end station having two groups of stub tracks and platforms arranged end to end but separated by a broad concourse or transverse platform is the unique plan adopted to meet the particular operating conditions. Different railroads use opposite ends of the station and the old arrangement consisted of three through tracks and five stub tracks at the north and south ends, with a concourse on one side of and parallel with them. This through-track plan is objectionable, however, and could not be permitted in a busy modern station, since it not only requires passengers to cross tracks at grade in going to and from the trains, but it also tends to confuse them in finding the right platform and train.

In both the old and new stations the tracks are below the street level. The old headhouse has the waiting

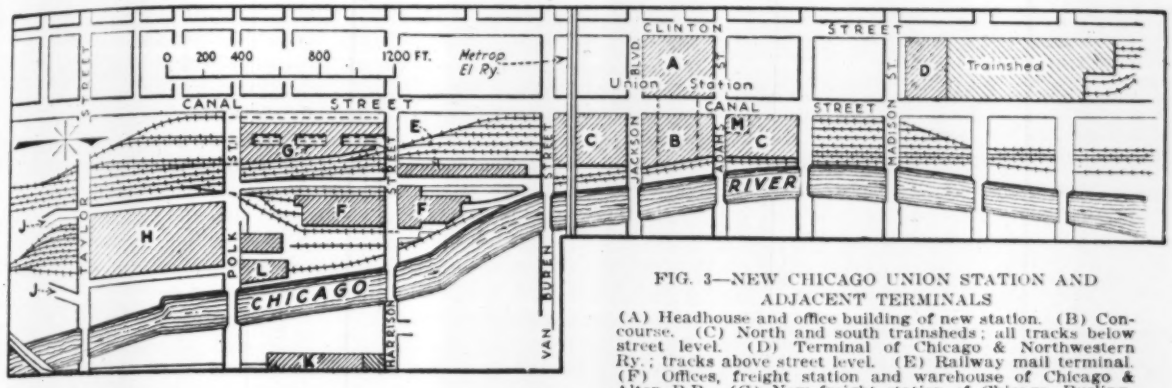


FIG. 3—NEW CHICAGO UNION STATION AND ADJACENT TERMINALS

(A) Headhouse and office building of new station. (B) Concourse. (C) North and south trainsheds; all tracks below street level. (D) Terminal of Chicago & Northwestern Ry.; tracks above street level. (E) Railway mail terminal. (F) Offices, freight station and warehouse of Chicago & Alton R.R. (G) New freight station of Chicago, Burlington & Quincy R.R. (H) Freight station and warehouse of Pennsylvania R.R. (J) Inclined driveways from viaduct to team yards of Pennsylvania R.R. (K) Grand Central Station (B. & O. R.R.). (L) Private warehouse. (M) Old headhouse of Union Station.

room and ticket office on the upper or street level, and it would have been possible to incorporate this arrangement in the new station by building the concourse as a bridge over the through tracks, with stairs or elevators to the platforms, as in the union stations at St. Paul and Kansas City. But in the design of this new Chicago station, to handle a heavy main-line and suburban traffic averaging a total of 255 trains in and out during 24 hours, it was considered by far the most desirable arrangement to locate all the main facilities at the track level. Then with the waiting rooms, ticket offices, baggage checking room and cabstand all at the track level, the logical track layout was the double-end stub plan described above and shown in Fig. 4.

A single through track on the east side provides for transfer movements between the two parts of the terminal. Beyond this are two through tracks of the Pennsylvania R.R., which road has two divisions using opposite ends of the station and therefore requires a through line. The site extends to the river, along which is built a concrete bulkhead or dock wall of gravity section supported on four rows of 35-ft. wood piles. Columns on this wall will support a driveway at street level, covering the through tracks.

Tracks and Platforms—In the south end of the station there are fourteen stub tracks with platforms of various lengths for trains of 7 to 18 cars, with their locomotives, allowing 70 ft. for each car. In the north end there are ten stub tracks and the platforms provide for 9- to 18-car trains. The total car capacity of the platform tracks is 191 cars in the south end and 141 cars in the north end.

Single tracks alternating with comparatively narrow platforms constitute an unusual station plan. This arrangement was adopted in order to keep all trucking clear of the passenger movements, each alternate platform being assigned for handling baggage and express exclusively. In the original design this plan was proposed, but in order to secure the maximum number of tracks in the given width of property it was at that time abandoned in favor of the more usual arrangement of tracks in pairs, separated by platforms 16 ft. 3 in. in width, each platform to be used for both passengers and trucking. In this second or modified layout two tracks of each group were assigned for loading and unloading mail. But these tracks were released later for general station purposes by the decision to construct a separate railway mail station, the location of which is shown in Fig. 3. This structure was described in *Engineering News-Record*, Dec. 22 and 29, 1921, pp. 1011 and 1058. Mail cars are switched between this station and their trains standing in the passenger station. On further study, therefore, it was decided to revert to the original plan of single tracks and separate platforms for trucking. In the adopted layout, Figs. 4 and 5, the widths of passenger and trucking platforms are 13 ft. 9½ in. and 10 ft. 9 in. respectively, with alternate track spacings of 23 ft. 3 in. and 21 ft. 6 in.

Low platforms are used, although high platforms approximately 4 ft. above the top of rail were planned originally, following the type of construction used in the Grand Central and Pennsylvania terminals at New York. Although there were advantages in this latter plan particularly in the convenience of passengers and the less vertical distance to be overcome between the car and the street, it was abandoned largely on account of the great cost of altering car equipment to adapt it for use at this one station. As constructed, the height of edge of platform above top of rail will be 7¾ in. for the passenger platforms and 20 in. for the baggage platforms. Since the passenger platforms are about 4 ft. below the concourse elevation and are reached by ramps having an inclination of 6.37 per cent, it is practicable to build high platforms later, if desired, without altering the present concourse.

The platforms will consist of reinforced-concrete slabs resting on concrete side-walls which are built on a 10-in. foundation slab of plain 1:3:6 concrete. Slabs for the passenger platforms are 6 in. thick at the sides, with a

FIG. 2—REMOVING OLD TRAINSHED OF CHICAGO UNION STATION

Station opened in 1880. Old headhouse and Adams St. viaduct at left. Swing bridge for Adams St. over Chicago River at right. During removal of trainshed traffic was handled temporarily on additional tracks between trainshed and river.

crown of 1½ in. at the middle and having ribs on the underside to lock with the side-walls. Slabs for the baggage platforms are 8 in. thick at the sides and have a slope of ½ in. in 12 in. from the center line. The underside is flat, without the ribs used on the passenger platforms. In all platform slabs the upper edge is finished with a curb bar with a radius of 1 in. A solid fill of sand or cinders is placed under the platforms, except that under some of the baggage platforms the space is left open to serve as a gallery for pipes, wires and other utilities. Temporary plank decks level with the rails were provided on some of the new platforms first put in service (see Fig. 4).

The separate trucking platforms will facilitate baggage handling materially, for with the baggage room placed beneath the concourse it can be connected with these platforms by ramps, the slope of which is 6.75 per cent. This arrangement eliminates the delay, first cost and operating cost incident to the use of elevators at the ends of the platforms to raise and lower baggage trucks. With the adopted arrangement, tractor-trailer trains will operate directly between the cars and the baggage room. An incline from the street on a grade of 4 per cent will lead to a driveway alongside the baggage room, with 380 ft. of tailboard space, so that wagons or motor trucks can receive and deliver baggage directly, without requiring elevator service.

Track Approaches—At each end of the station yard a six-track main line approach is provided, with tracks spaced 13 ft. c. to c. As the approaches are approximately in line with the east side of the station, the usual V or fan-shaped connection with the platform tracks is replaced by a double-track diagonal ladder, with slip and split switches enabling any approach track to

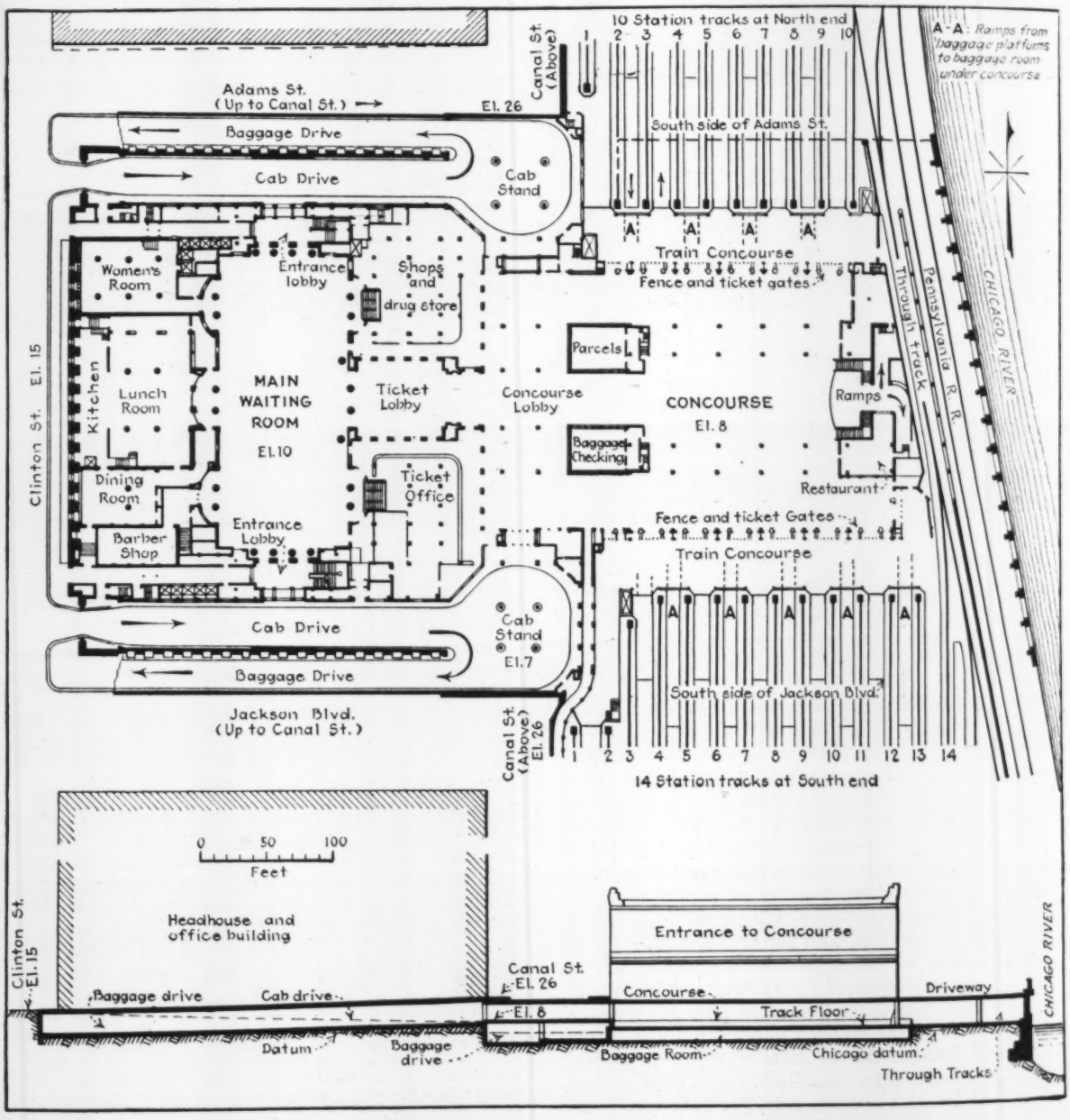


FIG. 4—PLAN OF HEADHOUSE, TRACKS AND PLATFORMS

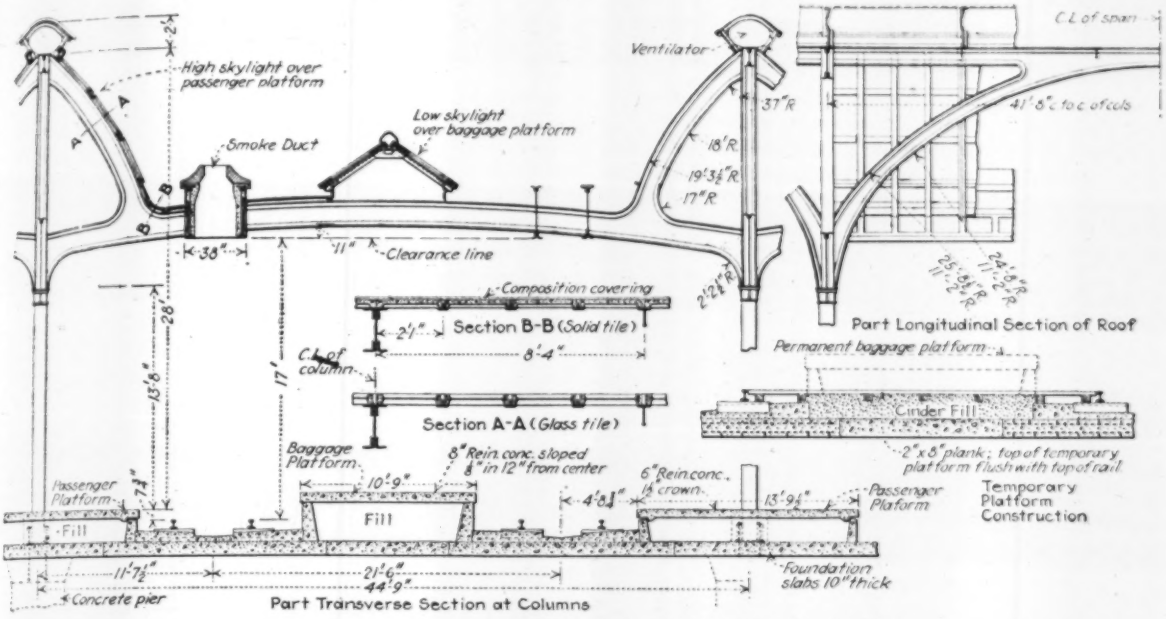


FIG. 5—TRAINSHED AND PLATFORMS: CHICAGO UNION STATION

be connected with any one of the platform tracks. Part of the south approach is shown in Fig. 6. There are thirty-three double slips and nine diamond crossings in the south yard and sixteen slips and six diamond crossings in the north yard. All slips are No. 8 or No. 9 and have movable-point frogs.

Track Construction—A concrete slab roadbed is another special feature of the station, this construction being provided under the ladders and slip switch connections and on part of the main-track approach. Since the subgrade elevation is only about 4 ft. above the water level in the Chicago River, which is close beside the tracks, the roadbed will be of necessity somewhat soft, in spite of drainage. Under the pounding of heavy loads, especially at the frogs and switches, the ballast would gradually be driven into the roadbed, so that continual work would be required in surfacing and adjusting track. Such work would be slow and costly, owing to the heavy traffic. It would also interfere more or less with train movements and would involve hazard to the trackmen.

In order to provide against this condition, the roadbed is covered with a 10-in. slab of reinforced concrete on 12 in. of cinders. The surface of the slab is approximately at subgrade level, but is formed in drainage planes, with sumps connected to a system of tile underdrains and served by automatic electrically operated pumps. Upon the slab is crushed stone ballast 8 to 10 in. deep under the ties. Where the concrete slab is not used the ballast is 12 in. deep under the ties. This unusual roadbed construction was described in *Engineering News-Record*, July 29, 1920, pp. 193 and 233.

In the station, each track has a reinforced-concrete slab, shaped to form a central drain, with creosoted red-oak or yellow-pine blocks embedded along each side, as shown in Fig. 7. These blocks are 6 x 8 x 30 in., spaced twenty to each 33-ft. rail. They are fitted with shoulder tie-plates 7 x 11 in. and ¾ in. thick, each plate being held in place by two spikes while two other spikes form the rail fastenings. These platform tracks have 100-lb., 33-ft. rails. On the approach tracks, 130-lb. rails are used, in 33-ft. lengths, spliced with four-bolt angle bars 24 in. long. Shoulder tie-plates as described above are placed on all ties and the rails are secured by 6½-in. drive spikes. All ties are of red oak, treated with zinc-chloride or creosote. The 10-in. slab under each track, with a width of 14 ft., is of 1:2:4 concrete. Above this, the concrete forming the track surface is a 1:1½:3 mix with a ½-in. cement finish.

Except for the slips and crossings, which were designed by the engineers of the Union Station, all track material is of Pennsylvania R. R. standards. Special work is avoided as far as possible in the complicated turnouts and switch layout. At the slip switches, the end frogs have manganese centers and cast steel heel and toe blocks bolted between ordinary rails. Switch rails are 15 ft. long with 4½-in. throw; movable-point frogs are 12 ft. long with 4-in. throw. Anchor straps, fastened at the heel joints of the rails and to the five ties on each side of the joint, or twenty ties in all, effectively prevent any creeping at switches. In the No. 8 slip switches, the length is 54 ft. 7 in. between switch points and 76 ft. 1¾ in. between the frog points of end frogs. Frog guard rails are of cast manganese steel. Main tracks on the approaches are spaced 13 ft. c. to c. The sharpest curves on these approaches are 12 deg. at the south end and 13 deg. 17 min. at the north end.

Signals and Interlocking—Design and location of signals constituted a special problem. With the complicated track layout and the limited lateral clearances, as well as the numerous low-level bridges across the tracks, giving only 17 ft. headroom, it was practically impossible to locate supports for signal bridges at the proper positions to allow full track capacity. To meet this difficulty, posts and semaphores are eliminated and the entire equipment consists of high and dwarf position-light signals. Dwarf signals are provided at the throat of the station, where all movements through the switches are made at low speed. High signals are used where the movements are numerous but generally with-

out diverging from one track to another. These latter are placed conveniently on the track sides of the parapet walls of street bridges which cross the tracks.

Position-light signals were adopted in preference to color-light signals, mainly for the reason that the former permit of a larger number of indications with a minimum size of signal. The indications are shown in Fig. 8. A new development in signaling is the four-position dwarf signal, giving the following indications: (1) "Proceed," two lights in a vertical line; (2) "Proceed under control," two lights in a 45-deg. line below the horizontal; (3) "Caution, prepare to stop at next signal," two lights in a 45-deg. line above the horizontal; (4) "Stop," two lights in a horizontal line. The second or permissive indication enables trains on the same track to follow each other with safety.

High signals on the approach have each seven lamps giving five indications by the arrangements shown in Fig. 8. The permissive signal indicates that the track immediately ahead is occupied but that the train may proceed prepared to stop at once. The slow-speed signal means that the route is set to diverge over a slow-speed turnout. The caution signal is a warning that the next signal is at "stop." Switch and signal movements are controlled from two towers, one at each end of the station.

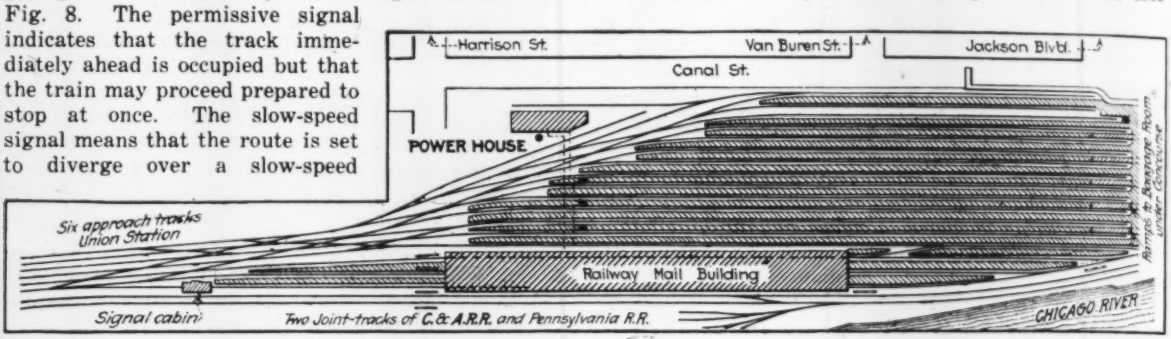


FIG. 6—TRACK LAYOUT OF SOUTH APPROACH

Low-Roof Trainshed—A steel-frame trainshed of the low-roof type was adopted after consideration of different types. This is in accordance with general modern practice, but for the Chicago station it was considered desirable to provide greater lighting and ventilating facilities than are provided in some low-roof trainsheds. In the design adopted, therefore, the low roof with open smoke duct over each track is supplemented by a high triangular ventilated skylight over each passenger platform and a low monitor skylight over each baggage platform. This arrangement, shown in Fig. 5, is somewhat similar to that of the trainshed of the Indianapolis Union Station (*Engineering News-Record*, July 10, 1919, p. 84, and Aug. 19, 1920, p. 351). The Indianapolis trainshed, however, does not include the continuous low skylights, since the tracks are arranged in pairs and special baggage platforms are not provided as at Chicago.

Columns supporting the transverse curved roof ribs are spaced 41 ft. 8 in. c. to c. along the middle of each passenger platform. They give a transverse span of 44 ft. 9 in. c. to c. of columns, with clearance line 17 ft. above top of rail. Longitudinal arched ribs are framed between the columns and support intermediate transverse ribs, thus minimizing the number of columns. Longitudinal girders framed between the ribs form the sides of the smoke ducts and will be cased in concrete for protection against corrosion. Instead of the smoke ducts being of uniform width, as is the usual arrangement, they are reduced from 32 in. in the lower portion to 18 in. in width at the top. This is done to afford the platforms additional protection against driving rain or snow, while it provides ample area for ventilation and for the escape of blast from the engines.

Cement tile laid on steel framing and covered with waterproof composition roofing will form the main part of the roof. Wire-glass tiling will be used in the high and low skylights, the glass being of a special tint selected after extended experiments to secure absorption of heat rays and thus avoid excessive heat in the trainshed during hot summer days.

This trainshed, covering both groups of terminal tracks and the concourse between them, will be 2,380 ft. long, with a width of 180 ft. 6 in. for the north yard and 250 ft. for the south yard. It will not extend over the three through tracks along the east side of the station, these tracks being covered by a driveway along the river front. For platforms built previous to the erection of the trainshed, temporary butterfly roofs of timber construction are provided. In the old station a steel truss trainshed with trusses of 66-ft. span on columns spaced 24 ft. 10 in. longitudinally covered five tracks and platforms. It was 84 ft. high from rail to top chord of truss. This structure, shown in the course of removal in Fig. 2, has been repaired and reinforced in recent years, owing to severe corrosion of some of its members, and has now been dismantled.

Headhouse Forms Office Building—In the old station, all facilities were east of Canal St. (see Fig. 3), the station building having its front on that street and the tracks lying between this building and a row of buildings (now removed) along the river front. To provide adequate accommodation for the new station, additional property was secured covering an entire block 296 x 320 ft. west of Canal St. as the site for the new headhouse. The river front property was also secured, so that the tracks and platforms will occupy all the space between Canal St. and the river, as shown in Fig. 3. A broad subway under the street will connect the headhouse with the other part of the station.

One of the fundamental features of the headhouse layout is the placing of all main station facilities at the track level, below the street. This arrangement is made the more easy and convenient by the fact that the street level falls west of the station. Thus Canal St., along the east side of the building, is at El.26; Clinton St., along the west side, is only at El.15, while the main waiting room is at El.10 and the concourse is at El.8. These levels are indicated on Fig. 4. Stairways, elevators and inclined walks and driveways will extend from the street level to the station level.

In accordance with the plan for a one-level station, at

the lower or main level are arranged the tracks, platforms, concourse, waiting rooms, ticket office, baggage room, dining and lunch rooms, cabstand and carriage entrance. On the upper or street level floor of the headhouse are arranged shops and the entrance lobbies to the main waiting room. Among the several special facilities provided is a jail or detention room where prisoners in transit can be held securely and kept apart from the traveling public. Entrances to the office portion of the building are entirely separate from those to the station.

The main waiting room is to be 100 x 217 ft., with a height of 114 ft. to a roof composed mainly of skylights. From this room a lobby 185 ft. wide, with ticket office along one side, will extend under Canal St. to the concourse, which is 190 ft. wide and 280 ft. long. A screen or railing on each side and provided with gates will separate the concourse from the train platform. Outside this railing will be a train concourse 36 ft. wide, by which employees or passengers can pass from platform to platform.

As planned in 1915, this new headhouse was to be a low structure, handsome in architectural design and devoted exclusively to station purposes. An office building was considered, but studies made at that time indicated that the location was not favorable, being several blocks from the business district. In the next few years, however, there was a decided trend of business to extend beyond this limited district and even across the river. Furthermore, financial conditions made it desirable to develop the air rights above the station for revenue-producing purposes.

When the headhouse design was again considered in 1919, at which time work on the terminal was resumed, it was finally decided to erect a 22-story office building over the site. This new design was described in *Engineering News-Record* of Dec. 1, 1921, p. 894, and the lower 8-story section is now under construction. This building will be 374 x 312 ft., with a central light court 132 x 204 ft. over the waiting room, the roof of which will be at approximately the seventh floor level.

Concrete cylinder piers founded on a deep stratum of hardpan at a depth of 60 to 66 ft. below city datum (or water level in the Chicago River) form the foundations for this building. There are 449 of these piers, of which 181 were required by the change to a 22-story structure after the foundations had been built for the low structure originally proposed.

With the redesign of foundations, trouble arose over a suggestion from the city authorities that the foundation should be carried to rock, at a greater depth. A combination of piers founded on rock and hardpan was considered highly undesirable for such a structure, besides which the additional cost for the deeper new piers would have been considerable. To demonstrate the carrying capacity of the hardpan, two piers were built in the usual way and loaded to a maximum of 87½ tons per square foot, with only slight deflection, as described in *Engineering News-Record* of Nov. 10, 1921, p. 763, and May 18, 1922, p. 822. As a result of this test the

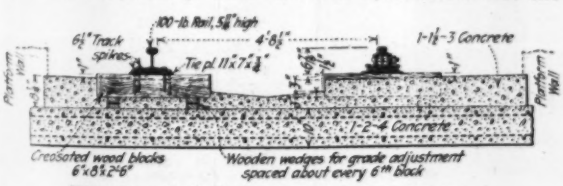


FIG. 7—STATION TRACK CONSTRUCTION

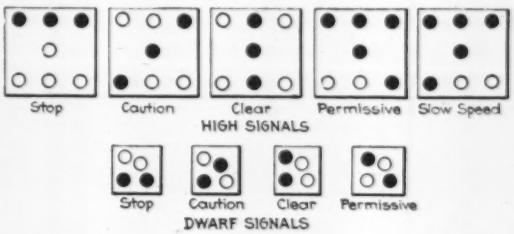


FIG. 8—POSITION-LIGHT SIGNAL INDICATIONS
Black spots show lights displayed for each indication. Open circles show lamps not lighted.

building commissioner approved the hardpan foundation with a load not exceeding 10 tons per square foot. A somewhat complicated arrangement of concrete girders on the piers is required to distribute the load and to provide supports for the new column arrangement in the larger superstructure.

Power House for Station—A complete power plant and electric generating station was proposed originally as part of the terminal. But in view of the great development of electric utilities in Chicago it has been decided to purchase all electric current. A power house south of the station will supply steam and compressed air service for the terminal, station and office building.

History of Chicago Union Station—The old union station at Chicago, put in service in 1880, was remodeled in 1892 to take care of the prospective heavy traffic of the World's Fair of 1893, since which time it has accommodated the ever increasing traffic with only minor alterations. The original Union Station Co. was formed jointly by the Pennsylvania R. R., the Chicago, Milwaukee & St. Paul Ry. and the Chicago, Burlington & Quincy R. R., with the Chicago & Alton R. R. as a tenant road. The Pennsylvania R. R. was the majority owner, since it had two lines using the station: the Pittsburgh, Fort Wayne & Chicago R. R. entering at the south end and the Pittsburgh, Cincinnati, Chicago & St. Louis Ry. entering at the north end.

Studies for enlargement and reconstruction were made at various times, but it was not until 1906 that a definite plan was proposed and was adopted by the several railways after extended negotiations. This plan was substantially what is now being carried out. It was submitted to the city authorities in 1913, an ordinance was passed in March, 1914, and was accepted by the railroads in June, 1914. Preparation of detail plans was then undertaken, but the opening of the World War halted the project and with the entrance of the United States into the war in 1917 the work was practically suspended.

While the old station occupied an area of about 225,000 sq. ft. with its buildings and tracks, the new plan required nearly 1,400,000 sq. ft., including land occupied by freight houses, team yards, a large electrical power house, large warehouses of wholesale firms and a number of streets with sewers, water and gas mains and the utilities of public service companies.

Before proceeding with work on the station proper, therefore, it was necessary to provide new railroad and other facilities to replace those to be destroyed and also to carry out extensive alterations to streets, bridges, bridge approaches, and various public utilities. As this work was scattered and largely underground it made no great show, so that the public has not realized the progress being made or the vast amount of work

required as a preliminary to reconstruction of the station. The additional work outside of the terminal has included three large freight terminals, a railway mail station and a 20-story warehouse built for Butler Bros.

Progress on the station proper up to July 31, 1923, included partial reconstruction of platforms, tracks and track approaches, demolition of the old trainshed, and partial erection of the steel frame for the lower portion of the combined headhouse and office building. Work was commenced in 1916, but was delayed by a 10-months strike and postponed indefinitely in the spring of 1917. When resumed in 1919, it was hampered by strikes, car shortages, high prices and the various other disturbances which followed the war period. It is now expected to have all the work completed by the end of 1924.

To carry out this extensive project a new company was organized under the name of the Chicago Union Station Co., in which the Pennsylvania R. R. owns 50 per cent of the stock and the Chicago, Milwaukee & St. Paul R. R. and Chicago, Burlington & Quincy R. R. hold 25 per cent each. The Chicago & Alton R. R. continues as a tenant road. No other railroads use this station. The company has its own chief engineer and engineering department in charge of design and construction, but for the consideration of important technical problems there is a board of advisory engineers composed of representatives of the three owning roads.

J. D'Esposito is chief engineer of the Chicago Union Station Co., and Thomas Rodd (formerly chief engineer of the Pennsylvania R. R.) is consulting engineer. Graham, Anderson, Probst & White are architects for the headhouse and office building. The John Griffiths & Son Co. has the contract for this building, the steel for which is being fabricated by the American Bridge Co. and erected by the Overland Construction Co. Foundation work was done by the R. C. Wieboldt Co. The cost of the station or terminal proper will be about $60,000,000, including land, trackage, signaling, station facilities and headhouse structure. The total expenditure involved in the terminal reconstruction, including also the new freight stations, railway mail station, warehouses, city bridges, street elevation and miscellaneous reconstruction of streets, viaducts and public utilities, will amount to approximately $95,000,000.

Mormon Flat Dam to Perform Regulating Service

Work has been pushed actively on the Mormon Flat dam, 27 miles below the Roosevelt dam on Salt River in Arizona. This improvement follows the increase in the storage capacity of the Roosevelt dam from 1,300,000 to 1,600,000 acre-ft. by the installation of 15-ft. gates in the spillway of the dam, which also gives an additional head for power. The Mormon Fat dam is being constructed primarily to increase the water power available to the Salt River Valley. The new dam, however, also performs a regulating service. It has a storage capacity of 90,000 acre-ft. Five power plants now are in operation which delivered 78,000,000 kw.-hr. last year. The construction of the new dam makes possible the installation of an additional 7,000-hp. unit. This improvement is desired because of the wide fluctuation between the minimum and maximum amounts of power now available. To carry out these improvements the Salt River Valley Water-Users Association bonded itself for $1,800,000.

Bronx Parkway Bridges Tested by Heavy Loads

Withstand Stresses Many Times as Great as Those for Which Intended, Including Weight of 70-Ton Excavator Used on Job

BY ARTHUR G. HAYDEN
Senior Assistant Engineer, Bronx Parkway Commission, Bronxville, N. Y.

THE PARKWAY drive in the new Bronx River Parkway Reservation, which extends from Bronx Park, New York City, to Valhalla, Westchester County, N. Y., crosses the Bronx River at several points and required the construction of about 30 drive bridges. It was originally intended that most of these bridges should be true arches, but the rise in cost of materials following the war led to the adoption for some of the shorter spans of a reinforced-concrete beam type. Some of the bridges have granite arch facing to resemble the much more costly stone arch bridge; others are faced with timbers so as to resemble rustic beam bridges. Some of these structures have had to carry abnormally heavy

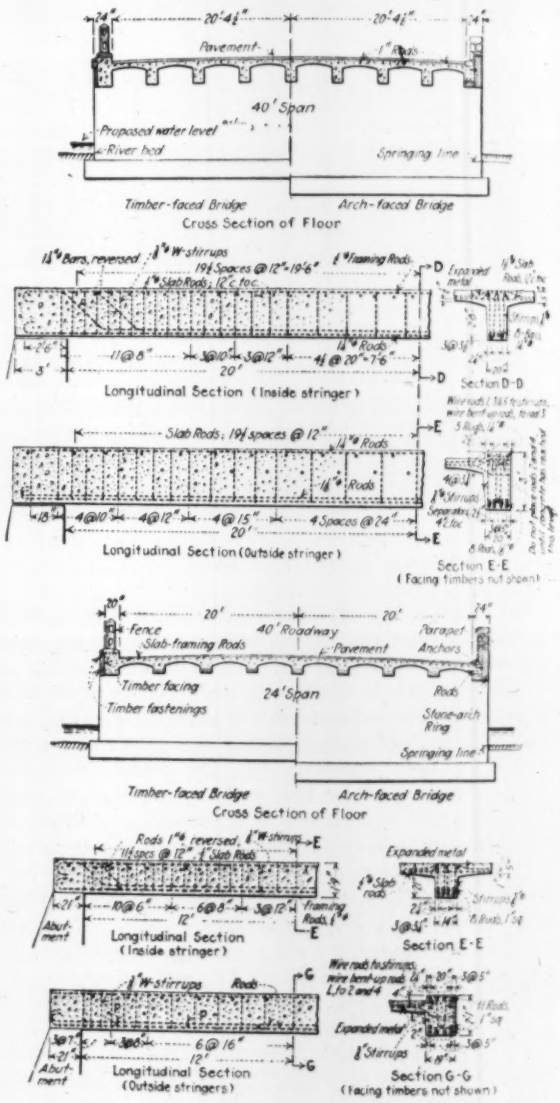


FIG. 1—FLOOR CONSTRUCTION OF BEAM BRIDGES

FIG. 2—TIMBER-FACED CONCRETE BEAM BRIDGE ON BRONX PARKWAY
North of Crestwood, N. Y. Span 35 ft., roadway width 40 ft.

loads, which they did safely. Stresses far beyond accepted limits of safe practice do not appear to have injured them.

The design of all the reinforced-concrete beam bridges was to some extent influenced by the dimensions of steel forms used in the construction of New York City subways, which had been purchased second-hand for Parkway use. Standard designs were made for clear spans of 24, 30, 35, 40, and 45 ft., all 40 ft. wide between curbs. Although commercial traffic will be prohibited in the Parkway, the bridges were designed to carry a concentrated load of 15 tons (including impact allowance) on two axles 11 ft. on centers, which will correspond to the heaviest maintenance machinery. There are no experimental data for determining the concentrated load distribution in floors like these, but judging from tests on floors that were different in design and have smaller stringer spacing it was decided that a fair assumption would be that about 80 per cent of a concentrated load would be carried by the underlying stringer. On this basis the assumed concentrated load would cause stresses of 16,000 lb. per square inch in the steel and 650 lb. in the concrete. Architectural requirements imposed a limit upon the depth of stringers which is less than the economic depth, but every structure has exhibited a great reserve of strength and rigidity under very severe test.

The Parkway Commission owns and operates many heavy pieces of construction machinery which had to be transported over the completed bridges as Parkway construction progressed. The heaviest is a Monighan 2-T dragline excavator, which weighs about 75 tons, and has crossed several of the bridges. This machine "walks," that is, during transportation it is supported alternately first on a circular base 15½ ft. in diameter and then on two "feet" or walking platforms, one on each side of the machine, each being 3½ ft. wide and 16 ft. long. It imposed a load on the bridge stringers several times as great as that for which they were designed, but none of the bridges which it crossed showed the least sign of distress. Such a test demonstrates the value of attention to the details of design and construction which is necessary to develop the strength of a member.

FIG. 3—DRAGLINE CROSSING CONCRETE BEAM BRIDGE
Structure similar to that of Fig. 1; span 35 ft. A 75-ton dragline excavator of "walking" type is crossing it, overloading the floor several hundred per cent.

For studying the effect of this emergency load, a wider lateral distribution in the floor should be assumed than given by the design rule. With the machine resting on the circular base, 70 per cent of the load is assumed to be carried by the three underlying stringers and distributed along a length of 16 ft. of the stringers, then the calculated stresses are 26,000 lb. per square inch in the steel and 1,020 lb. in the concrete. With the machine resting on the feet, assuming 70 per cent of the load on one foot to be carried by the underlying stringer and distributed along a length of 18 ft. of stringer, the calculated stresses are 34,000 lb. per square inch in the steel and 1,400 lb. in the concrete. Using a factor of 60 per cent instead of 70 per cent the calculated stresses are: with machine resting on the circular base, 24,000 and 960; with the machine resting on the feet, 30,000 and 1,200. The above calculations are for the 35-ft. span, over which the photograph shows the drag-

FIGS. 4 AND 5—TWO ARCHED BRIDGES—STONE ARCH AT LEFT, ARCH-FACE CONCRETE BEAM BRIDGE AT RIGHT
At left, bridge 33, located between Hartsdale and White Plains; a concrete arch of span 52 ft., rise 12 ft., with stone facing architectural design by Gilmore D. Clark, of Pelham. At right, bridge 13, Bronxville; reinforced-concrete beam bridge of 40-ft. span with arched stone facing; architectural design by C. W. Stoughton, New York.

line crossing. Calculated stresses for the bridges of 30, 40 and 45-ft. span would be nearly the same—a little greater for the longer spans.

On two 40-ft. bridges between Mt. Vernon and Bronxville a 30-ton bucket excavator operated in deepening the river channel, standing at the extreme side of the roadway and handling wet material with a ¾-yd. bucket at the end of a 45-ft. boom. Machines weighing 30 tons mounted on caterpillars of narrow tread, have repeatedly crossed nearly all of the bridges.

The commission's engineering department expects to make field tests on one or more of the Parkway bridges to determine, as closely as may be, the distribution of heavy concentrated loads over the stringers.

Kutter's *n* for Rough Rock Channel Excavated by Explosives

By C. E. Ramser
Senior Drainage Engineer, U. S. Bureau of Public Roads, Washington, D. C.

TO THE writer's knowledge Kutter's *n* has never been determined experimentally for channels excavated in rock by means of explosives where the condition of the channel was similar to that of the Sals Creek Diversion Channel in the Little River Drainage District, Mo., as shown in Fig. 1. Horton's table gives values ranging from 0.025 to 0.035—with 0.033 as the most commonly used values—for canals excavated in rock, which values are no doubt intended for use where the inside of the channel is made fairly regular and smooth. Engineers of the Little River Drainage District used a value of 0.045 in designing the rock cut of the Sals Creek Diversion Channel. Measurements on this channel were made by the writer to determine experimentally the value of *n* as a check on the design and to afford information for future application. The slope of the water surface was measured along two courses, one 255 and the other 161 ft. long, the latter course being included in the former. Measurements of seven cross-sections of the channel along the slope courses were made. No attempt was made to show the projecting rocks in the cross-sections but points were selected that represented fairly well the size and shape of the cross-sections. The discharge was measured with a current meter for two different stages in the channel with average maximum depths of 5.42 and 5.67 ft.

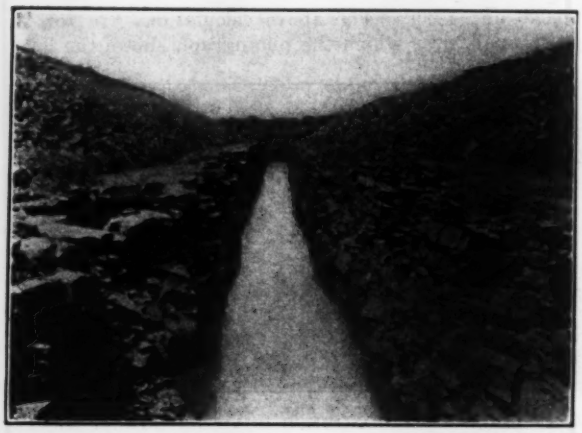


FIG. 1—SALS CREEK ROCK CHANNEL FROM LOWER END OF SLOPE COURSE

HYDRAULIC ELEMENTS AND VALUES OF *n* IN KUTTER'S FORMULA
Sals Creek Diversion Channel in Rock; Little River Drainage District, Mo.

Elevation Water Surface, Ft.	Average Maximum Depth, Ft.	Average Surface Width, Ft.	Discharge, Sec.-Ft.	Average Cross-Section Area, Sq. Ft.	Wetted Perimeter, Ft.	Mean Hydraulic Radius, Ft.	Slope of Water Surface	Mean Velocity, Ft. per Sec.	c	n
Length of Slope Course = 255 Ft.										
98.33	5.42	10.0	160.0	44.1	17.7	2.49	0.00268	3.63	44.4	0.0385
98.58	5.67	10.1	177.9	46.2	18.0	2.56	0.00288	3.85	44.8	0.0385
Length of Slope Course = 161 Ft.										
98.33	5.61	10.1	160.0	46.2	18.1	2.56	0.00279	3.46	41.0	0.0420
98.58	5.86	10.2	177.9	48.4	18.5	2.62	0.00274	3.68	43.5	0.0395

for the long course and of 5.61 and 5.86 ft. for the short course. The cross-sections are platted superimposed in Fig. 2, from which an idea of the shape, size, and uniformity of the cross-sectional area can be obtained.

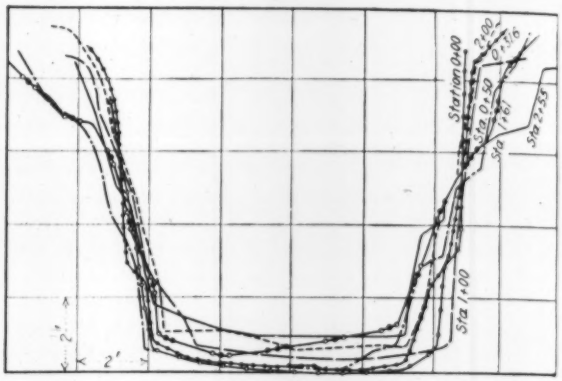


FIG. 2—CROSS-SECTIONS OF SALS CREEK ROCK CHANNEL ALONG COURSE OF SLOPE

Values of *n* in Kutter's formula, and hydraulic elements of the channel, are given in the table from which it is seen that the values of *n* obtained range from 0.0385 to 0.0420.

Ball Test for Measuring Concrete Quality

At Purdue University investigations have been made into the value of the ball test as a determinant of the quality of cement mortar and of concrete. This test consists in the application by pressure of small steel balls on the surface of concrete, the measure being the depth of impression made for various pressures. In a bulletin of Purdue University by R. B. Crepps and R. E. Mills, the following conclusions are drawn: The ball test applied to cement products affords a valuable and convenient means of determining compressive strength. It is a very reliable index of strength for any age or mix. By means of the test material already in place may be tested. It will be useful to contractors and inspectors in determining accurately when a concrete road may be opened for traffic or the forms removed from a structure. The test indicates a new means of studying the following questions in connection with concrete pavements: (a) effect of wheel loads upon surface strength; (b) effect of different types of tires upon surface strength; (c) effect of tire inflation upon surface strength; (d) distribution of damage on an area of contact; (e) effect of impact, and (f) recovery of surface strength.

Can We Best Do Public Work By Day Labor?

BY L. G. HOLLERAN
PAUL BROWN
CHARLES H. PAUL

The question of contractor versus force account is analyzed here in an article by Mr. Holleran, which was submitted for comment to Mr. Brown and Mr. Paul.

Advantages of Force Account System Favor Its Adoption

BY L. G. HOLLERAN
Deputy Chief Engineer, Bronx Parkway Commission, New York, N. Y.

WHY NOT carry on all municipal construction by force account instead of by contract? Important public works have been successfully constructed in this way. Among these are the Panama Canal, many of the U. S. Reclamation Service irrigation projects, the flood protection works of the Miami (Ohio) Conservancy District, and the development of the Bronx River Parkway Reservation in New York City and Westchester County, New York.

Statement of Force Account Problem—To do municipal work by force account, a large business must be conducted by the municipality; and any large business, to be successful, must have a permanent organization with a personnel commensurate both in ability and in number to the nature and importance of the business to be handled. The fundamental difficulty lies in building up and maintaining such an organization, owing to the constantly changing policies of municipal administrations and the likelihood of political interference.

Construction work in general is a manufacturing business, but, unlike factory operation, it is not generally susceptible of standardization beyond a rather moderate degree. It is a manufacturing business where different types of machinery and different materials are used, not for each job only but often for each operation. The selection of the machinery and often the selection of the materials, or some of them, is a matter of judgment which must be exercised not at considerable intervals as in factory operations, but daily and hourly. In other words, construction on a large scale is not only financially hazardous, but it requires for its economical and successful conduct the highest skill and judgment, not by a few men but by many men, often widely scattered and therefore not under the continuous and sustained control which can be exercised in factory operations where the organization is centralized in the factory buildings.

The two phases of the problem touched upon emphasize the necessity for mature deliberation on the feasibility of force account in any particular case before any attempt is made to adopt it. The conditions which may be considered favorable to adoption are noted in the adjacent panel.

Advantages of Force Account—Assuming that favorable conditions exist, let us consider the advantages to be expected:

(1) There should be a very considerable saving in time. Under the contract method, the contract and plans must be printed, and then approved; the contract advertised; bids taken and canvassed; bidders investigated, and contract and bond executed and delivered before work can be started. At least two months is the average time for this procedure and often it takes much longer. If the municipality were doing the work with its own forces, it could begin before all the detail plans were made, and the cost of printing, advertising, investigating, etc., would be eliminated. The cost of the bond and a considerable proportion of the cost of workmen's compensation insurance would also be saved, as municipalities would in most cases become self-insurers, and would be able to insure themselves at a fraction of the rates charged by the casualty companies.

(2) Changes in plan under the contract method usually mean additional cost and often a delay in completion. By force account both the delay and generally the additional cost would be eliminated; in fact the cost of the work might often be decreased by judicious changes in plans. It would also be possible to make many advantageous changes in plan which are not now made because the advantages to be expected are disproportionate to the delay and cost involved.

(3) Contractors seldom complete work within the contract period and very often meet with financial or other difficulties which make it necessary to readvertise the work. This procedure often delays completion for months or even years. Failure of a contractor almost invariably means litigation and financial loss to the municipality as it is difficult, if not impossible, to collect from the surety.

(4) Under the contract method, the municipality loses any benefit from a drop in the price of labor and materials during the life of a contract.

(5) There would be better control as a whole of work under construction. If conditions arose where one

Five Requirements for Success

As Set Forth by

L. G. HOLLERAN

(1) Assurance that the organization will be entirely unhampered by political interference.

(2) A municipal administration in sympathy with the method and ready to support it against attempts at political influence and against unjust criticism.

(3) Willingness to pay salaries commensurate with the ability required for successful operation.

(4) A construction program of such magnitude and planned ahead for such a time as to allow a reasonably large and permanent organization to be built up and maintained.

(5) Absence of restrictive laws and regulations, including civil service regulations, which would hamper the conduct of the work by this method.

piece of work was badly needed, it could be expedited at the expense of delay on another piece for which there was not such immediate need. This would not generally be practicable where the two pieces of work were under separate contracts.

(6) The cost of engineering and inspection service could be considerably decreased. It would not be necessary to make measurements and computations for progress estimates, and while it would not be possible to eliminate all inspection service, it need not be so severe nor expensive.

(7) With a large construction program and practically unlimited credit, the municipality would be able to purchase materials and supplies in quantity and therefore to better advantage than any except the very largest contractors.

(8) Probably the greatest advantage under proper and able management, would be providing work to take care of unemployment in slack times.

(9) Another great advantage would be the conduct of maintenance work on a more economical basis than at present by the interchange of forces and machinery between the construction branch and the maintenance branch.

Disadvantages of Force Account—There are obvious objections to force account construction:

(1) Most men look upon the expenditure of public funds differently from the way they look upon the expenditure of the funds of the individual, firm or corporation which employs them. They seem to lack power to visualize any particular one to whom they are required to account, and since no one person is going to be very much injured by lack of strict economy, they do not strive for economy.

(2) In the very nature of things there is bound to be a lack of incentive to produce economical work. In the first place, the funds of the individuals in charge of the work are not at hazard. If a contractor's costs for any item of work are higher than the bid or higher than he expected, he is naturally most anxious to find out why and to remedy conditions. Generally he puts forth the necessary effort to find a solution of the problem and lower his costs. Indeed his business life will often depend on finding the proper method. The case of the man in charge of construction of public works by force account is different. His business life will in all probability continue just the same whether or not the costs are within the estimate. It is far easier for him to say "we are doing the best we can" than to make that determined effort to lower costs which actually does lower them in the case of the contractor.

(3) Of much the same import is the lack of competition. Contractors know that in order to obtain a contract, their bids must be reasonable, and generally they are. Often they are too low which is bad for the municipality, and bad for the contracting business. Therefore, while competition has its merits, too keen competition, which leads to a bid lower than the price for which good work can be done, also has its adverse points. Moreover, competition can be developed under the force account method. Different superintendents and different foremen can compete against each other on items that are alike or comparable, bonuses can be offered for low costs and in time an organization, which would be eager to produce work at the lowest possible cost, can be built up.

(4) The municipality would have to stand the increased costs due to any rise in the price of labor and materials, such as might not have been foreseen by a contractor bidding on the same work. In the long run, a municipality would probably break even on the rise and fall of prices because it would also have the advantage of prices lower than those prevailing at the time the estimates were made.

(5) There will always be special and infrequent forms of structures or works requiring special equipment or especially trained workmen, which it will be more economical to contract for than to build by force account, because the infrequent use of special machinery would allow it to deteriorate rapidly and the machinery charges for such work as could be done by it would be much higher than the same charges to a contractor who has such equipment in continual use.

Small-Scale Test Inadvisable—Force account cannot succeed on a small scale for the reason that there would not be sufficient work to justify the employment of competent and able men to organize and supervise the labor force. The experiment would, therefore, be more likely to prove a failure than otherwise. If tried at all, it should be on a scale which would justify the employment of competent men and the purchase of adequate machinery and equipment for the classes of work to be undertaken.

On the other hand, it would not be possible to organize a labor force, purchase machinery, equipment and materials and take over all of the construction work in the larger cities on any certain date. The change would have to be made gradually; first taking over the paving, say, and then the construction of bridges, then the construction of docks, etc., with sufficient intervals between to allow the previous classes of work to get on a good working basis.

The magnitude of the construction business which would have to be organized in the larger cities is such as to fire the imaginations of the ablest organizers in the country. The head of the construction department in New York, Chicago, Philadelphia or San Francisco would have to be as capable as the presidents of our largest railroad systems or the general managers of the greatest manufacturing corporations.

If ably managed, such organizations would be schools for the younger generation of engineers and construction men, offering such a variety of experience as has never before existed in one organization in this or any other country. They could also well afford to maintain laboratories for research work in the use of new materials, new methods and labor and material saving designs for structures and equipment. Such laboratories are badly needed in this country if we are not to be excelled by foreigners in fields which we have heretofore considered peculiarly our own.

Conclusion—It is submitted that the organizations mentioned at the beginning of this article have demonstrated that the construction of public works of large magnitude can be economically and substantially carried out by force account, and it is thought that most of those familiar with present procedure will agree that there would be decided advantages in so constructing such works where favorable conditions exist or can be brought about.

The question whether or not the force account method can be generally adopted in view of the grave difficulties in the way of organizing labor forces which

could or would do the work economically is one which needs discussion to bring out the actual conditions from the viewpoint of public officials, engineers and contractors, and this article was written primarily as a basis for such discussion by one who believes that force account is going to be gradually adopted as the most economical and satisfactory method of constructing public works.

* * *

Conditions Favoring Day Labor Not Generally Possible

By Paul G. Brown
Contractor and Engineer, New York, N. Y.

SOME YEARS ago I did a large amount of tunnel construction for the city of Chicago by direct employment of labor and made very good progress and remarkably low costs so that I feel I can come to this discussion with an open mind. I was so puffed up with the success of this undertaking that when the editor of *Engineering Record* asked me to write an article describing the work accomplished, I gratuitously recommended that all municipal work be done by that method. Since that time I have been continuously engaged in construction work on the contractor's side and have come to the conclusion that only in very exceptional cases can public works of any kind be economically carried out by force account methods.

The Panama Canal was a matter of national pride and the government was able to secure first Mr. Wallace and then Mr. Stevens, engineers of great ability, both to plan and to organize, yet I have not the slightest doubt that any one of a half dozen of the then contractors would have organized to do the work more quickly and carried it to a finish in less time and at lower cost. I also think that a contractor on the job would have had the foresight to execute the work in such a manner that the closing of the canal after its opening would have been avoided.

The wisdom of the execution of the projects of the U. S. Reclamation Service by force account is being much discussed in the daily press at present.

The Miami District was very fortunate in securing Charles Locher to head this project. Few such men would ever be available for force account jobs.

We have just read of 1,600,000 men operating as well as maintaining the railroads with their present large volume of traffic, while 2,000,000 men under the government failed both in operation and in maintenance.

In Italy where the government is taking a hand at operation, the total receipts of the railroads in the past few months were not equal to the payrolls.

The municipal operation of the Detroit street railways is a startling object lesson to those who wish to learn.

My discussion will be limited to Mr. Holleran's five conditions "which might be considered favorable to the adoption of the force account method."

(1) The minor politician only stays in public life for such a period as he can please his constituents—and that is only as long as he can get jobs for the lame, the halt and the blind. The pressure for jobs is always too great to withstand.

(2) The administration might be able to support itself against unjust criticism but there will always be enough criticism to condemn such a method.

(3) The proper compensation for a qualified administrator to take charge of even a modest construction project is in excess of that usually paid to any municipal or state official, so that the chance of getting properly compensated and qualified leaders is very small.

(4) Readily possible.

(5) Most of our states and cities have civil service and other laws now enacted that would prevent the proper selection of men; as those best qualified could or would never pass examinations. These laws would also protect incompetents. The purchase of materials is so restricted by law as to be a great handicap.

Four of the five conditions assumed as necessary to successful conduct of force account work being found absent, further discussion would be fruitless.

* * *

Politics Hampers Force Account Construction

By Charles H. Paul
Chief Engineer, Miami Conservancy District, Dayton, Ohio

OF THE FIVE conditions favorable to force account methods, the vital one is: *"Assurance that the organization would be entirely unhampered by political interference."* With this assurance, one of the biggest handicaps to force account construction is out of the way.

Under present conditions of municipal politics, however, is it often that assurance can be had?

And if conditions are favorable at the inception of the work, is there a reasonable probability that they will continue so, over a period of years?

It is not safe to assume that the success of the work will be its own defense, because ordinarily public interest in routine municipal work is extremely phlegmatic. Criticism travels much farther and faster than praise. A small minority of active critics will make much more impression on the public mind than a host of satisfied observers who usually are undemonstrative and are attending to other business. The unscrupulous politician, though he may be quieted and pushed aside for a time, is never asleep. He is patient, shrewd, and accustomed to guiding public opinion. If it meets with his plans to get a hold on your municipal force account job, the chances are that in due time he will succeed.

The writer has been actively engaged in force account construction on public and semi-public work for a number of years. Two of the jobs most recently carried through on that basis were the Arrowrock Dam, for the U. S. Reclamation Service, and the flood control work for the Miami Conservancy District (Ohio). The economy of handling those jobs by force account has never been questioned and in both cases the work was finished ahead of schedule. Political influence was entirely absent in both of those organizations, due largely to the personalities and the uncompromising attitude of the men at the directive heads of the undertakings.

Such jobs as those cited, however, are in a different class from routine municipal work. You have a project of more than ordinary interest to the public, not only because of its unusual construction features, many of them almost spectacular, but because of its vital necessity from an economic standpoint. Speed and quality of work are two essentials which have first place in the public mind from the beginning. Community pride in the accomplishment of the unusual soon establishes itself. With public interest thus kept alive there is little danger of political interference. Furthermore the organization itself is tuned up to do a certain definite

job, starting fresh, with a clean slate. New associations, new surroundings, new problems, all make it easy to keep the men on their toes from the start.

Routine municipal work, on the other hand, is of a nature not to excite or hold the interest of the public, except perhaps for a short time or in a restricted locality. Political interference is much more likely to creep in and it is much harder to keep an organization keyed up to high efficiency. Municipal work of a special nature, however, like the development of a park system or a municipal light and power plant, or a water supply reservoir, may come in the first class.

It is the writer's opinion that political interference on force account construction for routine municipal work might be so hard to control as to make it inadvisable to attempt such an arrangement on a large scale or as a regular thing. Special conditions as to public sentiment, personality of leaders, labor or industrial conditions, may throw the balance the other way in certain cases. Projects of special interest, large enough to justify the expense of organization and equipment, may often be handled by force account at a considerable saving of both time and money, and without danger of getting into politics.

The other conditions mentioned by Mr. Holleran as favorable to force account construction need little comment. Not only should size of organization and adequate salaries be important considerations, but ordinarily the job should be large enough to justify the purchase, and absorb the cost, of suitable equipment. Only in unusual cases is it economical to rent equipment.

Savings from Day Labor—The advantages of force account construction under suitable conditions are many. The saving in time of getting started stands out as one of the most important. Of no less importance is the opportunity to change plans as the work proceeds in cases where the exposure of foundations, character of materials, or other considerations make such changes advisable. Many such changes have been made in force account work under the writer's direction, at a large saving in cost or time or both, which on a contract job might not have been practicable because of possible complications with contractor or surety company. The location of the Arrowrock Dam was moved several feet downstream after the exposure of bedrock, at a considerable saving in cost. A similar change at another dam of the Reclamation Service, which was being built by contract, resulted in extra work claims and a suit by the bonding company, with a final settlement which offset a large part, if not all, of the saving effected.

Changes in cost of labor and materials go where they belong in case of force account work, as do also costs of unforeseen difficulties such as floods, unfavorable weather conditions, etc. A contract bid usually covers a reasonable number of such contingencies, and the owner pays for them whether they occur or not. If they do occur, and amount to more than was anticipated, the owner usually pays in the end anyway, by way of delays, extra work claims, inferior work, or other alternative. He ought to. There is no justice in making a contractor responsible for conditions beyond his control, and little does it profit a community to secure a job at less than its legitimate cost. But on the other hand why pay for speculative contingencies which never occur? That cannot well be avoided in contract work; it is taken care of automatically by the force account method.

As to engineering, it has been the writer's practice to organize engineering and inspection just about as it would be on a contract job, measuring quantities periodically for the purpose of cost and progress records, and providing inspection in the same way, so as to assure quality of work while giving the construction forces full opportunity to concentrate on speed and economy of operations. The real saving in engineering comes from the fact that what is ordinarily classed as contractor's engineering—layout of construction plant, design of falsework, cost records, clerical work, etc., can be taken care of by the same engineering organization without additional expense. Then of course there is a profit to the job growing out of the feeling of co-partnership between engineering and construction forces, which is hard to translate into money value but is nevertheless real.

Interest Kept Up—Under "Disadvantages" Mr. Holleran mentions the danger of "letting down" on the part of the force account organization, and the lack of incentive to produce economical work. Isn't that largely a matter of personnel and conditions of operation? Published records of progress and costs, merit ratings, and perhaps a well planned bonus system, will go a long way towards keeping up the right spirit on the job. The sporting instinct in our American workman rarely fails to respond to a challenge. The job of keeping the progress line up and the cost line down, if put up to the men in the right way, brings out a surprising response, especially if night shift can be pitted against day shift, or one gang against another.

There has been no indication, in the writer's experience, that it is any harder to keep up interest on a force account job than on one done by contract. Output records are a good indication of the spirit of the job. At Arrowrock in four consecutive months 205,000 cu.yd. of concrete were placed in the dam, by three 1-yd. mixers, working 16 hours a day. In one month the output was 56,520 cu.yd., an average of better than 45 cu.yd. an hour for a month. As far as is known that is a record for that size mixer. On the Miami Conservancy work one 15-in. dredge pump put 91,500 cu.yd. of material into one of the dams during a month of 26 working days, two 10-hour shifts. At another dam two 15-in. pumps, one working only part time, pumped 180,000 cu.yd. into the dam. Over a million cu.yd. of hydraulic fill per year was placed in the latter dam in two successive years of nine working months each. One dragline machine equipped with an 85-ft. boom and 4½-cu.yd. bucket loaded 9,900 12-yd. cars with gravel, in one month of 26 days, two 10-hour shifts, an average of better than 190 cars per shift for a month. Those may or may not be world's records, but there certainly wasn't any loafing on the jobs where they were made.

Some effort has to be made of course to keep up enthusiasm on any job, whether it be force account or contract, but there are any number of ways of doing it, effective for foremen, superintendents and general managers as well as the men themselves. On the other hand, concern over financial difficulties on contract work, while a stimulus up to a certain point, may often become a real detriment to the job if it gets to be too serious.

Apathy on the part of the administrative officer himself is just as likely to be reflected in injudicious awards or indulgence to favored contractors as in lax attention

to force account work. Here again the special job stands out in a different class from that of routine operations.

Must Have Large Scale Work—Ordinarily force account methods can not well be tried out on a small scale, as has been said, but in some cases that has been done, and with marked success. The city of Dayton, Ohio, is now resurfacing with asphalt a number of streets by the force account method. As to rate of progress and character of work, the plan is highly successful. Very little additional equipment was needed over and above what was already required for street maintenance. The work is well organized, and the job is going ahead rapidly, and with very little inconvenience to the traveling public. It is understood that cost figures are considerably lower than have been obtained from recent bidding.

All of which goes to show that each job should be studied by itself, and whether or not it should be handled by force account depends largely upon the conditions surrounding that particular job.

Even on a force account job there are often many small incidental jobs which are better handled by contract, just as on a contract job parts of the work may be sublet to advantage. An organization built up to handle big work is not usually fixed to handle small isolated jobs economically. A small contractor with an outfit under his personal control can often take care of such jobs much better and at lower cost, because of close personal supervision and low overhead. Also, when a relatively small job requires special equipment or special methods, it is often possible to find a contractor fixed to handle it more satisfactorily than the main organization can. While the work of the Miami Conservancy District was a force account job, still there were many parts of it handled in this way by small contractors, with most satisfactory results. To overcome some of the disadvantages of straight unit price contracts, a cost-plus-variable-fee contract was worked out, which is virtually a compromise between force account and ordinary contract methods, combining some of the best features of both. A detailed description of that plan is given in Part IX of the *Technical Reports*, published by the Miami Conservancy District.

We know that force account methods, on a large scale, can be used to advantage and with economy, when conditions are favorable or suitable. Often there are conditions which are not suitable, as has been outlined in the original paper and in this discussion. Every job should be studied carefully before adopting force account methods to see that conditions warrant that arrangement. Because it has been conspicuously successful in some cases is no reason why it is always desirable. Generally speaking, routine municipal work, in the opinion of the writer, does not offer as attractive a field as do special jobs of greater public interest.

Canals Tonnage Shows Slight Increase

The Sault Ste. Marie canals carried during September 1,700,624 more tons than in September of 1922. Iron ore shipments increased from 6,658,148 to 9,480,891 tons; wheat fell off 14,885,743 bu., and other grains 7,366,433 bu. Total freight carried over the Welland canal last September amounted to 566,452 tons, as compared with 520,779 tons in September a year ago. On the St. Lawrence canals during September Canadian steam vessels showed an increase of 124,920 net tons, and United States vessels a decrease of 60,371 tons.

Timber Preservation in 1922

WOOD preservation in the United States during 1922 amounted to 166,620,347 cu.ft. of wood, or 20 per cent less than during 1921, according to a statistical report made by R. K. Helphenstine, Jr., U. S. Forest Service, and published in the annual "Proceedings" of the American Wood Preservers Association. The principal cause given for the smaller output is the reduced use of treated ties owing to the need of strict financial economies on the part of the railways, together with the coal shortage, the car shortage and the railroad strike. There was a volume reduction of about 25 per cent in ties treated and 36 per cent in wood blocks treated, but on the other hand there was an increase of 65 per cent in piles, poles, cross arms, construction timbers and miscellaneous material. In total there were 123,949,422 cu.ft. of ties, 3,947,551 cu.ft. of wood blocks and 17,008 cu.ft. of the third class.

The total consumption of creosote, paving oil and miscellaneous preservatives was greater than in 1921. But the consumption of zinc-chloride was less, owing probably to the fact that it had been used temporarily by several plants on account of the creosote shortage consequent upon the war.

Railroad ties represent by far the greatest amount of wood treated, constituting 75 per cent or more of the total annual treatment. Of the 41,316,474 ties treated in 1922 the preservatives and their amounts per cubic foot were as follows: Creosote, 20,208,362 ties, 6.59 lb.; zinc chloride, 17,418,107 ties, 0.50 lb.; zinc emulsion, 3,681,971 ties, 0.50 lb. zinc and 2.74 lb. creosote; miscellaneous preservatives, 8,040 ties. About 97.5 per cent of the ties were for steam railroads, and of these 4,841,464 ties were adzed and bored before treatment, 1,269,117 were adzed only and 178,594 were bored only. As to the woods used, 40.9 per cent of all treated ties were oaks (including all varieties); 23.1 per cent yellow pine; douglas fir, 9.4; beech, 6.8; western pine, 3.9; maple, 3.6; birch, 3.5; gum, 3.3; tamarack, 1.5; hemlock, 1.4; elm, 0.6; others, 2 per cent.

There were 144 timber treating plants in 1922, of which 128 were in operation; 89 were commercial plants, 30 railroad plants and 25 owned by mining and power companies or public utilities. Twelve new plants were built during the year and three plants were abandoned.

Domestic oil consumed (made from coal tar and water gas tar) amounted to 50,859,151 gal., as compared with 35,462,238 gal. of foreign or imported oil, or 59 and 41 per cent respectively. The consumption of paving oil was 1,414,682 gal. Miscellaneous preservatives amounted to 2,176,843 gal., showing an increase which is attributed principally to the use of petroleum oil and coke-oven tar to dilute creosote oil. The consumption of zinc chloride was 29,863,639 lb., or about 41 per cent less than the 51,375,360 lb. in 1921, which was the highest annual figure on record.

Waterproofing of Mellon Bank Foundation

Hydrolithic waterproofing was used in the foundation and basement of the Mellon Bank, described in our issue of Nov. 1, p. 714, in place of Cow Bay waterproofing cement mortar mentioned in the article. Cow Bay waterproofing was called for in the specifications, but the contract for the waterproofing was awarded to the Hydrolithic Waterproofing Co., of New York, for application of the material first mentioned.

Winter Building Is Practicable and Profitable

Speakers Before New York Building Congress Claim Lower Prices and Higher Output in Winter

"BUILD in winter and keep the architect, the builder, the subcontractor, and labor busy. It will better balance up the industry." These statements by John W. Lowry, Jr., struck the keynote of the winter construction conference held Nov. 21 by the New York Building Congress. "With an expenditure of $3,863 for protection of workers and materials and for heating," continued Mr. Lowry, "there was a saving of $87,710 on a job which cost $750,000." Giving details he said:

Considering the bricklayer production in the summer of 1922 as 100 per cent, in the erection of this job during the winter of 1922-23, the bricklayer production was 109 per cent. This last summer, the bricklayer production was 91 per cent. On this job, carried on during the winter, therefore, I produced 18½ per cent more brick per day per man than I was able this last summer.

Bricklayers got $10 a day. The payroll was $28,150. If the work had been conducted this last summer of 1923, the dropping off in production, or in efficiency, if you so choose to call it, would have added $5,360 to the cost of bricklayers alone. If the bonus of $4 be included, that is $14 per man per day, the bonus would have cost $11,260 more. In other words, the brickwork on this job would have cost $16,890 in addition to the $28,150 actually paid. The payroll for bricklayers, carpenters, labor and engineers amounted to $130,667. If the work had been done last summer, rather than the previous winter, the dropping off in production and the bonus award would have added $25,680.

In addition to the saving in labor on this job, the saving on materials and in sub-contracts amounted to $16,030 compared with prices in the summer of 1922. Between labor and the purchase of materials and sub-contracts, then, there was a saving of $87,710 on building work which cost $750,000. To offset this sum, the expenditures for winter construction were: Temporary protection to labor and material, $871; tarpaulins cost $667, with a salvage of $442, net cost $225; temporary heat, $668; salamanders, $302; coke, $304; boiler attendants, $1,036; coal for boiler heating $150; temporary lighting, labor and service, $196, and snow clearing, $111. These are a total of $3,863, or about one-half of one per cent of the total cost of the job.

That working with concrete during the cold season is practical from every standpoint was explained by W. J. Barney, president of the Barney-Ahlers Construction Co. He said:

From our files, I have taken three typical contracts, and the amounts given under the total contract column are practically for the reinforced-concrete structure, the enclosing walls, sash and roof, in other words, for that part of the building which requires protection from winter winds, freezing and cold in the course of construction. Once the building is enclosed, the matter of heating for the finishing trades is comparatively simple, especially if the permanent heating plant has promptly followed up the structural work. In a general way, about 5 per cent of the contract represents the cost for winter protection.

Total Contract	Time of Protection	Cost of Protection	Percentage Costs
$263,000	Dec.-Jan.	$13,000	5
180,000	Dec.-Jan.	8,800	4½
95,000	Jan.-Feb.	6,300	6½

This, however, does not represent the true cost of winter construction, as the cost of this winter protection, especially under present conditions of the labor and material markets, is more than offset by the lower cost of materials during the winter, the absence of bonuses paid to mechanics and the greater efficiency of mechanics under conditions when work is not so plentiful.

Take the past year for example, we find that lumber purchased in June would cost approximately 10 per cent less if purchased in November. We find that roofers, or 2-in. boards, which enter so largely into form construction, are purchased for $1 per thousand less in November than in August. We find that common brick entering into the curtain walls is purchased for $3 less per thousand in November than in August. We find that reinforcing steel is purchased for 7c. per hundred pounds less in November than in August, and we know that cement has had its seasonal drop.

Moreover, it is a matter of common record that during the past summer bricklayers were paid $14, $16 and $18 and even as high as $20 a day; that cement finishers were paid as high as $15 per day; that carpenters frequently received bonuses of from $2 to $3 per day, that all labor was scarce, difficult to obtain and very naturally not working at full efficiency under such conditions. We know that it is now possible to obtain practically all laborers and skilled mechanics, especially in reinforced-concrete construction, at the established union rates, and that, moreover, the men are anxious and willing to work efficiently and skillfully and have interest in holding their positions.

A still more vital factor to be weighed is the selling psychology of the general contractor which always follows a definite seasonal trend. In the spring and summer when work is plentiful, the general contractor and the special contractor will invariably place upon his work a considerably larger margin of profit and contingency, justifiably so against the skyrocketing of summer costs. In the fall when work begins to become scarce and the contractor is confronted with the problem of holding his organization together during the winter months, he will invariably lower his percentage of profit and take work on a closer basis as to contingencies, appreciating that he will be able to manage, control and direct his work far more efficiently during the winter months than in the summer; and, consequently, can operate safely upon a closer margin than when he does not know from week to week, as during the summer months, whether mechanics' wages will increase two, four, six or eight dollars per day.

I have had our estimating department take from their files typical estimates and, using these various factors, the same building would have been estimated by us in August at $208,000 and today for winter construction at $203,000, showing a saving to the owner of at least $5,000 or 2½ per cent, this including all cost of winter protection. Therefore, under present labor and material conditions, it is certainly conservative to say that winter construction costs no more than summer work.

Railway Statistics for 1922

A preliminary abstract of statistics of common carriers for the calendar year 1922, issued by the Interstate Commerce Commission, gives the following particulars of first-class railroads, exclusive of switching and terminal lines:

Miles of road	234,986
Miles of second track	32,321
Miles of main track, sidings and yards	382,101
Operating revenue	$5,559,092,708
Operating expenses	4,414,522,334
Net revenue from operation	1,144,570,374
Gross income	1,191,674,595
Net income	371,256,333
Steam locomotives	64,139
Other locomotives	373
Freight cars	2,293,402
Passenger cars	54,354
Company service cars	105,610
Ties laid in replacement	86,639,547
Ties laid in additions and extensions	4,110,213
Rails laid in replacement, tons	2,618,556
Rails laid in additions (only 374.76 miles main track), tons	197,788
Total freight carried, tons	1,840,954,570

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Engineers May Be Eligible for Scholarships

Sir—Since writing the memorandum mentioned in your editorial of Nov. 29, 1923, p. 873, which expressed the then official attitude of the Department of Education of New York in regard to scholarships in engineering courses, we have had a conference with certain deans of engineering schools and we have agreed upon an amendment to be submitted to the legislature next winter which will, I am very sure, be entirely satisfactory not only to all the engineering schools of the country but to the engineers as well. By this amendment, if it shall be enacted into law, applicants for scholarships pursuing engineering courses will be eligible to receive such scholarships. I am glad to give you this information which you are at liberty to use as a postscript to your criticism of the department.

Albany, N. Y., Nov. 30, 1923. AUGUSTUS S. DOWNING, Directing Professional Education, State Department of Education.

Why the Garden City Project Failed

Sir—Your articles on the trail of the truth about reclamation have been of more than ordinary interest to me. I especially enjoyed reading the article by F. H. Newell on Origin, Problems and Achievements of Federal Land Reclamation, but I cannot agree with Dr. Newell when, with reference to the Reclamation Service project in Kansas, he says, "this project did not succeed largely because the climate was not sufficiently arid."

The Garden City project was planned to pump groundwater to supplement the river supply for the Farmers' Ditch, a ditch which had been in operation since about 1880. Much information regarding this project was given in the 1905 report of the Reclamation Service. The proposed plant was to "recover an average of 100 sec.-ft. of groundwater during the irrigation season of five months, to be delivered into the Farmers' Ditch about one mile northeast of its headgates."

The cost of construction was to be about $30 per acre, based on the 8,600 acres then under that ditch. Charges were to be in two parts, the first a fixed charge of approximately 75c. for each acre of land under the project, whether the owner used water or not, the second charge for distributed water, the cost of which, based upon a total of 25,000 acre-ft. delivered to the water users, would be 77c. per acre-foot. On this basis a water users' association was organized, and on Sept. 14, 1905, an allotment of $258,000 was made for the construction of this project.

Before the project was completed and put in operation the construction charge was raised to $37.50 per acre. The charge for maintenance and operation was raised to a minimum of $2.75 whether water was used or not; 2 acre-ft. per acre was to be furnished. In addition to these charges it was required that the water users operate and maintain their distributing system "at their own expense."

The delivery of water was begun in 1908 with 10 of the 23 pumping units installed. The others were utilized as they were installed in June and July, but the amount of water pumped that year is not given in the annual report. In 1909 the plant was in operation 96 days and 7 hours, and pumped a total of but 7,555 acre-ft. of water. This was at an average rate of a little less than 40 sec.-ft., or less than 40 per cent of the expected amount. Furthermore, running this small amount of clear water in a ditch having a capacity of 200 sec.-ft., which the Farmers' Ditch had, resulted in an unusually large ditch loss, and a wholly inadequate quantity of water reached the land. Upon the failure of the Service to deliver the expected amount of water, the farmers refused to pay the assessments and the project was abandoned.

If, as Dr. Newell says, the project did not succeed because the climate was not sufficiently arid, it was only because the climate was not sufficiently arid to compel the farmers to pay an almost prohibitive price for an unsatisfactory amount of water to supplement their river supply, and not because they did not appreciate the value of water. As an irrigation engineer I have been in close touch with irrigation at Garden City for more than ten years, and personally know many of the farmers under the Farmers' Ditch. They have consistently utilized all the water available, and if a dependable supplementary supply could be developed at a reasonable cost they would gladly avail themselves of it. Of the five ditches in operation in the Garden City district in 1905, all are well maintained and are in operation at this time. In 1922 they diverted and used 67,800 acre-ft. of water out of a total of 107,500 crossing the state line into Kansas during the water year Oct. 1, 1921, to Sept. 30, 1922.

Furthermore, the failure of the Reclamation Service to develop a satisfactory water supply from wells did not demonstrate that it was not practical to pump groundwater. Within recent years about 20,000 acres in that district have been brought under irrigation by private pumping plants on individual farms. These plants cost from $2,000 to $2,500 for units having a capacity of 3 or 4 sec.-ft., which is large enough for 160 acres. This is a construction charge ranging from $12.50 to $15 an acre. Operation costs are about $2 an acre annually with electricity, which can be obtained at 4c. per kilowatt-hour.

The Garden City project failed partly because the Service was unable to construct and operate the project within the figure fixed in the original agreements, but in larger part because of the fact that they failed to deliver the water for which charge was being made. The increase in both cost of construction and charge for maintenance and operation had caused some dissatisfaction among the water users, but this could have been overcome had it not been for the fact that the Service was unable to deliver the water for which charge was made.

Topeka, Kan., Nov. 6, 1923. GEORGE S. KNAPP, State Irrigation Commissioner.

Traffic Congestion Costs

Sir—In connection with your editorial, "Capitalizing Traffic Congestion Cost," in the issue of Nov. 8, p. 747, the following may be of interest.

The cost, merely in terms of gasoline consumption, of starting from a stop the cars in a heavy traffic stream is not generally realized. About 42,000 ft.-lb. of energy are required to accelerate a ton of car weight from a stop to a speed of 25 m.p.h. One gallon of gasoline will furnish approximately 4,200,000 ft.-lb. of effective energy when burned in the average motor vehicle now in use. In other words one hundredth of a gallon of gasoline is consumed in accelerating every ton of car weight from a stop to a speed of 25 m.p.h.

If 10,000,000 cars of an average weight of 1½ tons move through the traffic stops of Fifth Avenue each year and make on the average five stops per car, approximately 750,000 gal. of gasoline will be consumed in accelerating the vehicles in the traffic stream. At a gasoline cost of 20c. a gallon the driving public spends about $150,000 per year for the fuel required to bring the cars up to driving speed after traffic stops, or the interest on an investment of $3,000,000. Were each car stopped and the engine idled for five minutes during its trip on the Avenue, the annual expenditure for gasoline so consumed would be about $50,000, or an additional capitalized cost of $1,000,000. Although I do not have the exact number of traffic-control stops on Fifth Avenue per year, the above figures at least indicate the magnitude of the annual cost to the driving public of two of the items of the cost of car operation through traffic stops.

Washington, D. C., Nov. 27, 1923. WILLIAM S. JAMES.

Temperature of Irrigation Water

Sir—Plans are being made for a large hydro-electric development in Japan where the river water is used for the irrigation of rice. The rice growers are fearful that the temperature of the water drawn from the storage reservoir to be constructed will be lower than that at present drawn directly from the river.

The plans as submitted for the government permit provide for a dam to raise the water surface about 210 ft. with a storage of about 20,000 acre-ft. The minimum flow of the river is about 1,000 sec.-ft. The intake as planned provides for a draw down of 50 ft., so as to give a regulated flow of about 1,500 sec.-ft. The reservoir will, however, be full during the rice growing season.

The rice growers' associations insist that the plans be changed to provide for drawing the water from near the surface of the reservoir unless evidence is submitted to show that water drawn 50 ft. below the surface of the reservoir will have a temperature as high as that of the river water under existing conditions.

The only printed information which we have found on this subject is contained in the following papers in the Transactions of the American Society of Civil Engineers: "Temperature of Water at Various Depths in Lakes and Oceans," by Hamilton Smith, Jr., Vol. 13, p. 73; and "The Temperature of Lakes," Desmond FitzGerald, Vol. 34, p. 221.

These papers show that in reservoirs during the summer months lower temperatures increase with depth to certain limits, but no information has been found to show the temperature of water at various depths, as compared with the temperature of the running water in the river.

Any information which can be furnished on this subject will be much appreciated. E. C. MACY,

Manager for Japan for Stone & Webster, Inc.

Boston, Mass., Nov. 5, 1923.

Contract Bond Reform

Sir—I was interested in the editorial in *Engineering News-Record*, Nov. 8, p. 748, entitled "Contract Bond Reform."

I heartily agree that 1½ per cent is too high a rate for responsible contractors to pay, and that this rate is due to the "unwise risks which are constantly being taken."

In this connection, I am enclosing extracts taken from a letter I recently wrote to a large bonding company, which may be of interest.

It is probable if negotiable securities are accepted in lieu of bonds, the bonding companies will be compelled to select their risks with more care, and reduce their rates. Of course a material reduction in rates will be possible if the bad risks are eliminated. FRANK M. WEAKLEY,

Norfolk, Va., Nov. 10, 1923. Civil Engineer.

[The discussion inclosed by Mr. Weakley follows.—EDITOR]

Some years ago I was bonded on a building contract. The standard rate at that time was 1 per cent but I paid 0.8 per cent because my business was "preferred."

The agent informed me that he personally investigates his patrons and prospective patrons, and upon his recommendation they were given a special rate.

In checking up on contractors who have gone bankrupt, leaving the bondsmen to finish the work at a loss, I find that in most cases the risk could have been ascertained by the bondsmen by a proper careful investigation.

You will note that a large proportion of the bankruptcies are cases where the contractors have been in business for a number of years.

The manner in which a business is being operated can be learned in a number of ways, apparent to me, or to anyone else sufficiently interested.

If a business is being poorly managed, it is usually only a question of time until it goes broke, causing a loss to the bondsmen.

I had difficulty in securing my *first* bond; after that it was easy.

The biggest losses to bonding companies are from contractors who have been operating for a number of years, sufficiently long for anyone interested to ascertain how they were handling their work.

A contractor who gives personal attention to his work, who pays his bills promptly, handles his workmen intelligently, treats his sub-contractors fairly, and secures his work at reasonable prices will nearly always succeed. He is a good risk.

The man who does the opposite is a bad risk, even though he has to his credit a number of completed contracts.

Why then, do not the bonding companies establish credit and investigation offices in the larger cities which will check up on their risks and prospective patrons?

These offices can get information as to how the contracts are being executed, the payments made on material and labor, payments to sub-contractors, and, in fact, everything regarding the way the contractors are handling their work and finances.

Such an office should be independent of the agent who writes the business, just as the fire insurance offices which fix rates are independent of the agents who write the fire policies.

As a practical business man and builder, I can see no good reason why a careful check on contractors' work cannot reduce losses considerably.

I have occasionally been surprised by seeing contractors of questionable reputation and ability secure bonds from large companies who later on had to make good on the failures that were to be expected.

National Construction Week Advocated

Sir—I note the editorial in *Engineering News-Record*, Nov. 1, 1923, p. 704, relative to the possibility of a Construction Show.

I am sending you a little article I prepared some months ago along the same lines, which may interest you. The possibilities are immense, and while perhaps Atlantic City is the only town with sufficient hotels and display facilities to accommodate a real Construction Week, I think a biennial or triennial meeting can gradually be brought about, and it would certainly put the construction industry on the map of the United States. Alternate years, each national association could move about the country as its best interests might require, and take the mountain to Mohammed through America, which is perhaps equally essential.

A. P. GREENSFELDER,

Secretary, Fruin-Colnon Construction Co.

St. Louis, Mo., Nov. 15, 1923.

[The following extract from the article forwarded by Mr. Greensfelder contains the substance of his proposal.—EDITOR.]

The idea of a national construction week is that the National Federation of Construction Industries could arrange the first two days of that week, taking up the broad construction problems of interest to the entire industry, such as transportation, finance, standardization, co-operation, etc., referring the problems back to each group for the co-operation of their organizations. On the following three days of that week, it is hoped that the various groups, such as the Associated General Contractors of America, the American Institute of Architects, the Builders' Exchanges, the recently formed federation of engineering societies, the Material Dealers' Association and a lot of other national associations, could hold their individual conventions in different hotels simultaneously in the same city. On the last day of the week the executives of the various national associations could again gather together under the leadership of the National Federation of Construction Industries, reporting the action of their various organizations and establishing a uniform policy of action for the coming year.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

At the Recent Convention of the City Manager's Association in Washington, D. C., Montreal was chosen as the next meeting place and George W. Thompson, Westmount, Que., as first vice-president. The new president is Earl C. Elliott, Wichita, Kansas.

For the Statue of Colonel William F. Cody (Buffalo Bill) Mrs. Harry Payne Whitney, sculptress, has engaged Russell Kimball, engineer, of Casper and Cody, Wyo., to take charge of the erection of the base. The base will be of red granite quarried from the Shoshone canyon and the estimated cost is $40,000. The statue when completed will be placed near the city of Cody, Wyo.

The First National Conference on Immigration is to be held in New York City, at the Hotel Astor, Dec. 13 and 14 the call having been issued by the National Industrial Conference Board, New York. An attendance of 2,000 of the nation's leading industrialists, public officials, leaders in business and trade organizations, and authorities on social service is expected. All sessions will be public.

Hiressi Yamamato, Marine Superintendent of the Japanese Government Rys., Tokyo, Japan, has arrived in Canada to study the car-ferry system which connects Prince Edward Island with the mainland. It is the intention of the Japanese Government to connect the southern island of Yesso with the larger one of Hondo by means of a car ferry over a strait about 60 miles broad, conditions being somewhat similar to those of the Northumberland Strait.

Winnipeg, Manitoba, Has Adopted a by-law for the issue of debenture bonds to the amount of $550,000 for the purpose of establishing a central district steam heat producing and distributing plant in connection with the city hydro-electric standby plant. The total cost will be $875,000, leaving a balance of $325,000 to be transferred from the capital account of the hydro-electric system. The work will be proceeded with as soon as enough heating contracts have been signed to insure the success of the system.

Application for a License Covering the remainder of its projects on the Tallapoosa River has been made by the Alabama Power Co. The company has recently completed the survey of the entire stream by means of aerial photography and has found that the estimated storage capacity of the upper region has been over-estimated. Consequently it proposes to increase the height of the Cherokee Bluff dam from 105 to 150 ft. The five additional dams are to be constructed above the Cherokee Bluff dam, which will have a combined head of 306 ft. and an installed horsepower of 114,000.

Knickerbocker Theater Co. Wins Three Damage Suits

The Knickerbocker Theater Co., Washington, D. C., has been exonerated of civil liability in three of half a hundred cases brought against it as a result of the collapse of the theater's roof Jan. 28, 1922. The three suits, the first civil cases to be decided, were for $10,000 damages each, and were based on the death of two patrons and the injury of a third. Attorneys for the plaintiffs will seek a new trial, and if that is not granted, intend taking the cases to the Court of Appeals.

Japan To Spend $525,000,000

Conditions in Japan are gradually becoming settled. Military law has been discontinued and sufficient temporary structures have been provided to care for all who were without shelter, says a cable received by the Far Eastern Division of the Department of Commerce from its Tokyo representative. It is unofficially estimated that reconstruction expenditures during the first five years will reach only $525,000,000, of which amount $375,000,000 will be spent in Tokyo and $150,000,000 in Yokohama, indicating that either the damage caused by the earthquake was not as great as it appeared, or that the program of reconstruction will be carried out over a long period of years.

International Board Disallows Rio Grande Claim

Fred K. Nielsen, agent for the United States before the American and British Claims Arbitral Tribunal, has informed the Department of State that the claim of the British Government for £755,400 with interest against the government of the United States, known as the Rio Grande Claim, has been dismissed by the arbitral tribunal which is now sitting in London. The claim is based on an alleged interference by the Government of the United States with real property rights at Elephant Butte, Sierra County, New Mexico, of an English company called the Rio Grande Irrigation and Land Co., Ltd., which about 1896 had taken steps to construct a dam in the Rio Grande River at Elephant Butte. Pursuant to acts of Congress approved Feb. 25, 1905 and March 4, 1907, respectively, a dam was constructed at Eagle, New Mexico, a short distance below Elephant Butte, as a result of which the site of the dam which the Rio Grande Irrigation and Land Co., Ltd. had proposed to construct at Elephant Butte was submerged. The company's dam had not proceeded beyond the initial stages (it is said that the small beginning had been practically obliterated by floods, etc.) and the time limit within which the law required completion of the work had meanwhile expired.

Huge Appropriation Asked for More Western Reclamation

An appropriation of $250,000,000 by Congress for Western reclamation is demanded in a resolution passed by the Western States Reclamation Association in its third conference, held at Salt Lake City, Nov. 18-20. The association also voted thanks to Secretary of the Interior Hubert Work and to the Reclamation Commissioner D. W. Davis for their work in dealing with reclamation problems. The claims of the South to federal reclamation expenditures were recognized in a resolution assuring the South that the West wishes to co-operate with it.

Several principles of future reclamation policy were advocated in formal resolutions. They include "completion" of existing projects, legislation to give the government a percentage of the increase in value of land when sold prior to full payment of the government charges, formation of interstate agreements on interstate water problems, and international agreements on international water problems.

R. E. Shepherd, Jerome, Idaho, was elected president, and W. L. Boise, Portland, Ore., vice-president. The executive committee includes: R. E. Caldwell, Utah; W. G. Wendsen, Idaho; W. E. Meacham, Oregon; C. Pease, Texas; J. M. French, New Mexico; D. A. Scott, Washington; William Wisener, Arizona; F. L. Lucas, Colorado; A. Lindley, California, and R. A. Smith, Nebraska.

Work Favors Department of Public Works

Washington Correspondence

Secretary of the Interior Work states that he is ready and anxious to co-operate in the effort looking to the establishment of a major division of public works in his department. Secretary Work expressed this determination last week to L. W. Wallace, the executive secretary of the Federated American Engineering Societies, whom he called into special conference on this subject.

Secretary Work told Mr. Wallace that he is in entire sympathy with the Brown plan for reorganizing the Department of the Interior. That plan provides for the division of the Department into two major branches, one to deal with public works and the other with matters of the public domain. The public works branch is to be under the immediate direction of an assistant secretary, who is to be an engineer. Secretary Work went so far as to suggest to Mr. Wallace that the engineers begin thinking of a man who would be qualified to fill that position.

In his conversation with Mr. Wallace, Secretary Work made the point that it would be wise to provide for the use of Army engineers in connection with the public works program. He expressed the opinion that Congress would not approve of the plan unless this were done.

Ohio Filter Operators Discuss Problems

Practically Every Plant in State Represented—Sand, Chlorine, Iodine and Carbonation

Engineering News-Record Staff Report

All but two of the sixty-five water purification plants in Ohio were represented at the third annual conference of operators, Nov. 21 to 24, at Columbus. Probably no other state has so many purification plants under laboratory control, for even the smallest plants have a laboratory for "minimum" determinations, each supervised by a technically-trained operator of a larger plant, who may have as many as five plants to which he gives attention and for which he is responsible to the State Board of Health which must approve his employment.

Besides the dozen papers on filtration, water softening and carbonization, the "tricks of the trade," or original features of plant operation, were described. A joint session on iodine and goiter was held with the county district commissioners of Ohio. The unanimous opinion seemed to be that medication with iodine in the water was wasteful (only 0.4 per cent used) and much more expensive than individual treatment. A day was used to visit the softening plants at Newark, where an 8-m.g.d. plant under construction has a baffled mixer, and at Delaware, where mechanical mixing is used in the 2-m.g.d. plant, completed last year.

Carbonator Experience

Experience with carbonators at the Defiance plant was given by H. T. Campion, superintendent, who stated that the filtros plates for distribution of the CO_2 had been replaced by perforated pipes with satisfactory results. Sand growth has been prevented with 1 to 10 p.p.m. of CO_2 in the effluent. C. P. Hoover, chairman of the conference and chief chemist, Columbus, described a carbonator recommended for Newark and Columbus. Flue gas, scrubbed to free it from CO_2 and water, is blown through porous concrete blocks, the gas being distributed through the bottom of the blocks by a perforated pipe. Ordinarily any steam-producing pumping station furnishes double the amount of CO_2 necessary for the carbonation process.

F. E. Sheehan, superintendent, Portsmouth, has found that a secondary application of coagulant midway in the 8-hour detention period reduces his alum dosage and gives higher efficiencies, particularly as shown by the B. coli index. Progress being made by the U. S. Public Health Service in the study of efficiency limitations of water purification processes, was outlined by H. W. Streeter, sanitary engineer. A 0.16-m.g.d. experimental filter has been installed at Cincinnati and a survey is under way of sixteen plants from which monthly reports are received.

Electrolytic action between brasses of different composition in the East Liverpool filter strainers, said D. H. Rupp, was partly responsible for underdrain troubles which finally resulted in revamping the underdrains. Strainers were found plugged with concrete and oakum. In some cases plugs were found in lieu of strainers. Tons of sand were taken from the false bottom. A control valve did not work and was found installed backwards.

The newly elected officers are: Chairman, Clarence Bahlman; vice-chairman, W. I. Van Arnum; secretary, E. E. Smith.

Chinese Engineer Prominent in Flood Protection Work

Among China's prominent engineers is S. W. Lao, formerly director of the Yellow River Bureau in Shantung from 1918 to 1922. He is a native of Shantung, was educated in Tientsin, China, where he studied engineering; has followed railroad engineering for twenty-five years. He has had active practice in railway location, construction, and maintenance on several of the principal roads of China including the Shanghai-Hangchow, Tientsin-Pukow, Peking-Mukden, and Chinese Eastern. In 1918 he was put in charge of the work of the Yellow River Bureau where he remained until his appointment as Vice-Minister of Communications at Peking in the summer of 1922.

Accept Principle of Arbitration for Standard Contracts

Acceptance of the principle of arbitration by the representatives of the American Railway Engineering Association and a reconsideration of certain other contract principles which pave the way for a general agreement were the outstanding accomplishment of the Joint Conference on Standard Construction Contracts at its meeting in Washington, Nov. 19.

The railway engineers submitted a detailed criticism of the documents previously formulated with which they were not in full accord and those matters which could not be immediately agreed upon at the meeting were referred to a sub-committee which will report about Dec. 10. The sub-committee is instructed to reach a basis for universal agreement on each of the contract provisions referred to it, redrafting these provisions if necessary and submitting its recommendations to the conference for approval.

As a result of discussions in the past year the sentiment among all of the representatives actively participating in the conference has crystalized into agreement upon an arbitration clause, with the exception of the National Association of Builders' Exchanges which has not yet rendered a definite report. There now appears little doubt that within the next few months unanimous agreement will be reached in the conference upon both the building and the railroad documents.

Associations represented on the Joint Conference are: American Association of State Highway Officials, American Institute of Architects, American Railway Engineering Association, American Society of Civil Engineers, American Water Works Association, Associated General Contractors of America, Federated American Engineering Societies, National Association of Builders' Exchanges and the Western Society of Engineers

To Start $12,000,000 Water-Works Extensions at St. Louis

The sale before Feb. 1, 1924, of $2,000,000 of the $12,000,000 water bond issue voted by the people last February has been authorized by the St. Louis Board of Estimate and Apportionment, in accordance with the program of E. E. Wall, water commissioner. The money will be used for the construction of railroad yards, buying rights-of-way and for constructing intakes and engine pits. In June pipe lines connecting the new water-works with the city mains and in September the construction of the new settling basins are projected. The entire program for 1924 contemplates an expenditure of $5,590,000.

Reopening St. Louis Zoning Case Denied by Court

The Missouri Supreme Court, on Nov. 20, denied a petition of the City of St. Louis for a rehearing of its recent decision against the validity of the zoning ordinance under which the city has been acting for some three years past. The earlier decision held that the zoning ordinance was beyond any police power granted to the city by the state. The latest ruling confirms the earlier one but appears to be somewhat more specific in that it says, in part: "The ordinance before us provides for the taking of private property for a public use without compensation and without a judicial hearing. It is not a regulation that would fall within a reasonable exercise of the police power. It is confiscation, pure and simple."

Court Holds Public Utilities Act Cannot Invalidate Contract

The U. S. Supreme Court in the suit of the Superior Water, Light & Power Co. against the city of Superior, Wis., reversed the lower courts which had held for the municipality, declaring, in effect, that a state legislature is without authority to invalidate contracts between public utility corporations and political subdivisions.

The predecessor of the Superior Water, Light & Power Co. had been granted a 30-year water-supply franchise by the city of Superior. Subsequently this franchise was amended to provide either a 25-year extension or purchase of the plant by the city on a fixed basis of payment rated on income. After this amendment the water company made extensive improvements and extensions. The Wisconsin public utility act of 1907 provided that utility franchises should be indeterminate, and subsequent legislation made the indeterminate franchise mandatory.

When the franchise expired, the Superior Water, Light & Power Co. called upon the city for an extension or for purchase of the plant according to the terms of the franchise. The city refused, relying upon the state act, and started condemnation proceedings to acquire the plant by terms other than those in the franchise. The company resisted in the courts. In upholding the contentions of the company, the Supreme Court asserted that the franchise and its amendment constituted a valid contract, not subject to abrogation by the state public utilities act.

Proposes Power Development on the Headwaters of the Tennessee

The Federal Power Commission has received an application from the newly-organized Southern Appalachian Power Co., of Asheville, N. C., for a preliminary permit covering a 170 ft. dam and power house to be constructed at a point on the Hiwassee River one mile above Murphy, N. C. The dam would control the annual run-off of the river and provide a low-water flow of 1300 c.f.s. It is estimated that 50,000 hp. could be developed at this site.

The most attractive feature of the project, however, arises from the fact that 400 ft. of head can be developed in the river below Murphy, which would make possible the development of 150,000 hp. in that stretch.

The Hiwassee is a tributary of the Tennessee and has its source just over the ridge from the Tugaloo and other streams which have been so thoroughly developed on the eastern slope of the range. This new development will increase the low-water flow at Muscle Shoals by 10 per cent, and will benefit materially the Hale's Bar project of the Tennessee Electric Power Co. It will also increase the navigable capacity of the Tennessee.

Incidentally this development would drown out the dam proposed by the town of Andrews, N. C., a small municipality which is defying the Federal Power Commission. It has sold its bonds and has let contracts for its project which is seven miles above the site of the Southern Appalachian Power Co. Materials are being transported to the dam site. The district representative of the Corps of Engineers has instructions to request an injunction from the Federal Court when ground is broken.

Electrify and Elevate New York West Side Freight Line

The new plan for a general revision of the west side freight line of the New York Central on Manhattan Island, New York, noted in last week's news pages, is submitted by the railroad company in order to clear up the matter of how it is to conform with the legislation requiring the electrification of this line and at the same time eliminate all grade crossings.

The plan as now submitted is similar in many respects to the one which was submitted in 1916, but does not include the expensive subway work along Riverside Drive. As far as possible in this new project the railroad company has endeavored to keep to its present right-of-way, thus avoiding the question of obtaining large parcels of land from the city, one of the stumbling blocks in the way of the other plan.

The present terminal at St. John Park will be abandoned and also all tracks below Canal St. The construction of the vehicular tunnel westward from Canal St. makes this change necessary. A new elevated terminal will be built north of Canal St. between Washington and West Sts. with trucking space and platforms under the tracks at street level. North of this terminal a two-track elevated structure will be built along a private right-of-way roughly parallel to Washington St., to near 14th St., where the elevated structure will be carried along 10th Ave. for three blocks on account of the new warehouses built or building in that area. From this point it will again continue in private right-of-way west of 10th Ave. to the 30th St. yards, where it will turn west to the marginal way along 12th Ave. The 30th St. yard will be an elevated structure but will have some street level tracks west of 11th Ave. to connect with the car ferry slips. From the 30th St. yard to the 60th St. yard will be a four-track elevated structure along the marginal way. At 60th St. the tracks will come down to the present level of the yard, but the east side of the yard, now occupied by stockyards, will be developed into a double-deck structure, the upper deck being for the delivery of milk and perishables. North of this yard the railroad will have five tracks at grade on the present right-of-way as far as Manhattanville, with over-crossings at 79th St. and at 96th St.

At Manhattanville the railroad will be carried over the West 125th St. valley on a six-track elevated structure to the yard, which will have two track levels. Continuing north, the tracks will come down to grade as a five-track line to Fort Washington Park and then four track to Dyckman St., where it will be elevated over the street and ferry entrance. The plans call for a small yard at this point for local business. North of Dyckman St. the track will be carried on a four-track fill to Spuyten Duyvil creek, which it will cross on a new high-level bridge having the same clearances as the other Harlem River bridges. Above the bridge, overhead connections will be made to the north and east, and some changes will be made in the location of the main line to the east to conform with the new ship canal plan.

George W. Kittredge is chief engineer for the New York Central on this work and J. M. Doorly is engineer of West Side improvements.

Construction Council Announces Apprenticeship Committee

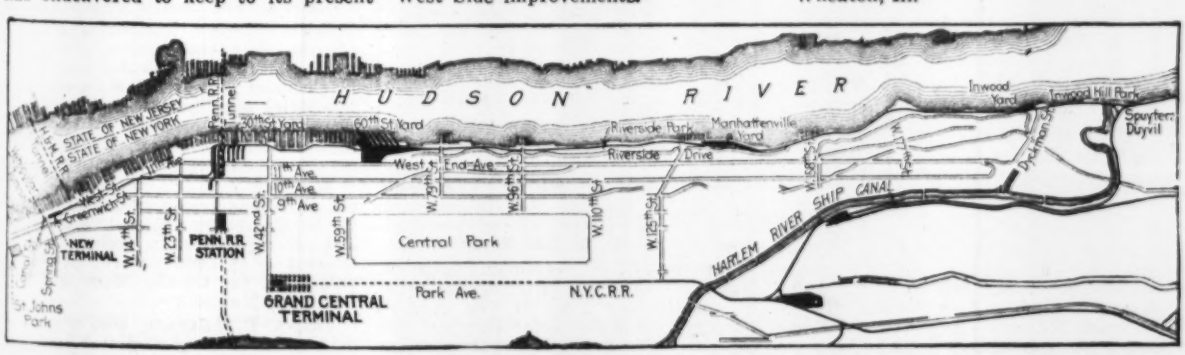
The American Construction Council has announced the personnel of the Committee on Apprenticeship, Vocational Guidance and Craftsmanship, of which F. W. Walker, of Beaver Falls, Pa., is the chairman. The committee will co-operate with employees' and employers' organizations, building congresses, and all other elements in the construction industry, and with the educational bodies, local and national, in providing for apprenticeship which will be attractive to young men and will afford the fullest means for the employment and training of efficient workers as apprentices, and will produce the skilled workmen needed in the construction industry.

Members of the committee are: James Baird, New York; Charles F. Bauder, Philadelphia, Pa.; E. L. Bowman, Evansville, Ind.; Howard L. Briggs, Cleveland; H. Whittemore Brown, Hampton, Va.; Prof. W. W. Charters, Pittsburgh; Wharton Clay, Chicago; R. L. Cooley, Milwaukee, Wis.; John W. Cowper, Buffalo, N. Y.; George Dautel, Cleveland; John Donlin, Washington, D. C.; F. L. Dykema, Grand Rapids, Mich; Burt L. Fenner, New York; R. C. Gaskill, Atlantic City, N. J.; Frank M. Gunby, Boston; Lewis Gustafson, St. Louis, Mo.; Fred. J. Hartman, Pittsburgh; Dr. L. S. Haskins, Chicago; Warner S. Hays, Philadelphia; Mr. Malcolmson, Detroit, Mich.; G. A. McGarvey, Washington, D. C.; A. H. McChan, Washington, D. C.; James S. Meade, Philadelphia; Fred F. Moran, New York; W. Stanley Parker, Boston; Thomas R. Preece, Indianapolis, Ind.; C. A. Prosser, Minneapolis, Minn.; H. H. Rosenberg, Chicago; Ralph P. Stoddard, Cleveland; M. F. Westergreen, New York; L. C. Wason, Boston; R. Winstead, Chicago; Edward L. Wertheim, New York; and J. C. Wright, Washington, D. C.

Ex-officio members are Franklin D. Roosevelt, New York; D. Knickerbacker Boyd, Philadelphia; and Dwight L. Hoopingarner, New York.

Illinois Society Meets Jan. 9 to 11

The annual meeting of the Illinois Society of Engineers will be held Jan. 9 to 11 at the University of Illinois, Urbana-Champaign, Ill. The program is now in preparation and it is proposed to arrange a session for operators of sewage-disposal plants. H. E. Babbitt, assistant professor of sanitary engineering at the university, is president. The secretary is E. E. R. Tratman, Wheaton, Ill.



PROPOSED IMPROVEMENTS IN NEW YORK CENTRAL FREIGHT LINE ALONG THE HUDSON RIVER AT NEW YORK

Random Lines

The Interstate Commerce Commission, in order No. 13,462, finds that something about shipping "pancake flour in carload lots" is unreasonable. Shades of all the small boys on Sunday morning—Can there be that much pancake flour?

* * *

Pronounced In-jeé-ner

Sir—Referring again to the popular abuse of the term "Engineer":

I am not a Latin scholar nor a delver into languages, but have observed relationships and ancestry of many of our modern English words when glancing through my "Websters Unabridged Dictionary."

I find that most words beginning with or containing *gen* or *g n* pertain to creation, production or reproduction; we have *gen*esis, meaning the creation; *gen*itive, pertaining to reproduction; *gen*ius, one of creative or inventive mind; likewise in*gen*uity the quality of ready invention, etc. Then, eureka! I find the word "ingē'ner," one who contrives, a "designer," but, alas, it has (obs.) tacked onto it. This last seems to be the nearest ancestor or possibly an older disinherited brother to our modern "engineer."

The English have always had a habit of changing and modifying the spelling of words from their original. The continental European languages all spell the word, beginning with "ingen"—like the French "ingenieur."

And herein lies another inconsistency: where, in other European nouns, denoting vocation (adding *er* and *or* to a verb to denote one who), the accent is on the last syllable, the English always pronounce with the accent *before* the final *er*.

Now, according to this pedigree, an engine or a gin really means any works which have been contrived or designed by an "ingener."

In this respect a bridge or any fixed structure and all kinds of machinery, which would include sewing machines, washing machines, etc., as well as the steam engine (properly, motor), is an engine, hence why should those who operate steam motors be called engineers at all. If so called, then the woman who operates a sewing or a washing-machine is an engineer and every one is an engineer because practically everyone operates or cares for some device designed by an ingener.

The ingener, as a designer, has to precede the operator for the reason that the father precedes the son.

If the trade-and-lay-people in general persist in using the term so promiscuously, lets have that (obs.) deleted from the dictionary and have it read, "ingener, one who etc." and "engineer, (obs.) see ingener."

It is easy to say—just put the accent back in its English or American place. Now, all together,

"Ingē'ner."

* * *

The Chicago Daily Tribune's booze hound (who is a sleuth and not an inebriate as in the early use of that solecism) has found that the prize speakeasy in the big lake city hides behind an office door labeled "International Council of Experimental Engineers' or something." Let's hope its "something."

Tile Manufacturers' Association Ordered Dissolved

Washington Correspondence

Collection of trade statistics practically is limited to those which may be requested by a governmental agency, is the final decree in the case brought by the Department of Justice against the Tile Manufacturers' Credit Association. The proceeding was in the United States Court of the Southern District of Ohio. Before the decree was made final the law department of the National Association of Manufacturers urged the Department of Justice to permit the periodic collection of facts relating to capital employed, power used, wages, taxes paid, fuel consumed, machinery employed, in addition to production, sales, shipments, stocks, prices and like pertinent trade information. It was specified that all such information was to be a record of accomplished facts.

It is known that the Department of Justice gave long and careful consideration to the proposal. The significance of the decree is increased greatly by the fact that the collection of trade statistics is not made permissible after the Department's study of the proposal. It is anticipated that this decree will have a far-reaching effect upon trade associations.

In the decree the credit association is ordered dissolved, though it again may function in accordance with rules laid down by the court as an educational and research body and for the interchange of certain credit information.

Engineering Societies

Calendar

Annual Meetings

FEDERATED AMERICAN ENGINEERING SOCIETIES, Washington, D. C.; Annual Meeting, Washington, D. C., Jan. 10-11, 1924.

AMERICAN ROADBUILDERS' ASSOCIATION, New York City; Annual Convention, Chicago, Jan. 14-18, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York, Jan. 16-18, 1924.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Meeting, Chicago, Ill., Jan. 21-24, 1924.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 22, and Ottawa, Jan. 23, 24, 1924.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting (20th anniversary), Chicago, Ill., Feb. 25-28, 1924.

The Engineers' Club of Philadelphia will hold a meeting Dec. 18 at which J. Franklin Stevens will give an address on the Pacific Islands and Japan.

The Society of Terminal Engineers, New York City, will have for discussion at its meeting Dec. 11 the subject, Cartage Practice at Inter-Terminal and Off-Track Freight Stations; the speaker will be J. F. Murphy, vice-president of the Terminals Co., St. Louis, Mo. At the meeting of the society held Nov. 13 the following officers were elected: President, Maurice W. Williams; vice-presidents, J. Spencer Smith, William Joshua Barney, Edward Anderberg, M. A. Long, and H. C. Yost; secretary-treasurer, Charles H. Newman.

Personal Notes

R. H. SHERLOCK, formerly structural engineer with the American Bridge Co., at Toledo, Ohio, has taken up duties this fall as assistant professor of civil engineering in the college of engineering, University of Michigan.

W. M. SPANN, division engineer for the Missouri State Highway Department with headquarters in Kansas City has been promoted to engineer of construction at Jefferson City, succeeding A. C. Lingley, recently resigned. H. M. BRUSH, assistant engineer of construction, will fill the vacancy caused by Mr. Spann's promotion. A. R. AXOM, division maintenance engineer at Williow Springs, has been made assistant engineer of construction.

JOHN ALBERS has been appointed city engineer of Beverly Hills, Calif.

DR. PAUL WHITFIELD HORN, now president of Southwestern, University, Georgetown, Texas, has been appointed president of the new Texas Technical College at Lubbock, Texas, and will assume the duties Jan. 1. For the construction of Texas Technical College, the architects are SANGUINET, STAATS & HEDRICK, of Ft. Worth with WILLIAM W. WATKINS of Houston and CRAM & FERGUSON of Boston as associates. L. W. ROBERT of Atlanta and Dallas will be consulting engineer. The college will be opened in the fall of 1924.

MALCOLM RAMSAY, Greenville, Texas, has been appointed city engineer of Temple, Texas, and will have charge of an extensive paving program.

WALTER A. SHAW, consulting engineer, Chicago, and formerly member of the Illinois Public Utility Commission, has been appointed a representative of the city of Chicago on the Board of Supervising Engineers, Chicago Traction.

EZRA B. WHITMAN, consulting engineer and a member of the Public Service Commission of Maryland, will become chairman of the commission Dec. 31, at which time the resignation of William Milnes Maloy, present chairman, will become effective.

ROBERT ISHAM RANDOLPH, secretary of the Randolph-Perkins Co., engineers, has been nominated (equivalent to election) vice-president in charge of industrial development and public improvements of the Chicago Association of Commerce. Major Randolph has served on ten committees since 1915.

WILLIAM J. GRAY, who for the past ten years has been civil engineer in the U. S. Engineers office at Wilmington, Del., has resigned to become superintendent of the water-works at Springfield, Mo., for George West & Son of Portland, Maine.

FRANK E. SHEPARD, who was president of the Denver Engineering Works until it consolidated with Stearns-

Roger Manufacturing Co., and a consulting engineer since that time, has been appointed superintendent of the Denver Mint. Mr. Shepard graduated from the Massachusetts Institute of Technology in 1887 as a mechanical engineer.

ALEXANDER POLLOCK has been appointed field engineer by the zoning commission of Denver, Colo. He will check up the various types of buildings and work in conjunction with the commission toward the perfecting of a new zoning ordinance.

DWIGHT P. ROBINSON & CO., INC., of New York, has opened an office in Atlanta, Ga., in the Healey Bldg., with W. RAWSON COLLIER in charge. Mr. Collier for many years was with the Georgia Ry. & Power Co. and more recently with the Poughkeepsie Gas & Electric Co. He is a graduate of Massachusetts Institute of Technology.

WILLIAM OEHRLE, formerly with the George A. Fuller Co. and recent manager of George A. Fuller Co. of the Orient, Ltd., announces the opening of an office at 342 Madison Ave., New York City, where he will transact his business of building construction.

Obituary

COL. ARCHIBALD O. POWELL, of the firm of Powell and Jacobs, consulting engineers, Seattle, Wash., died suddenly at his home in that city, Nov. 18. Col. Powell was born in Milwaukee, Wis., and graduated from the University of Wisconsin in 1880. He was for many years attached to the U. S. Engineers office with headquarters in St. Paul. In 1906 he moved to Seattle to take charge of the original Lake Washington Canal Project and upon completion of that engagement entered private practice as a consulting engineer, specializing in river and harbor work. He is a past-president of the Pacific Northwest Society of Engineers and of the Seattle Section, American Society of Civil Engineers. He served as a captain of engineers in the Spanish-American War and as a Lieutenant-Colonel of Engineers in the World War.

THOMAS J. WYCHE, San Francisco, Calif., consulting engineer for the Western Pacific Ry., died recently, at the age of 64 years. He was a native of Mississippi and a graduate of the University of the South. Mr. Wyche built many large water systems for the Union Pacific R.R., and tunnels for the Western Pacific at Sherman and Aspen, Colo.

WILLARD A. SMITH, publisher of the *Railway Review*, who died at Evanston, Ill., Nov. 29, was known specially for his work as chief of transportation exhibits at the Columbian Exhibition, Chicago, 1893; Louisiana Purchase Exhibition, St. Louis, 1904, and Paris Exhibition of 1900. Mr. Smith was born at Kenosha, Wis., in 1849. He was an affiliate of the American Society of Civil Engineers and a member of the Western Society of Engineers. He was prominent in the work of the Railway Master Mechanics and Master Car Builders Association before they were absorbed as the mechanical section of the American Railway Association.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Interviews with Industrial Executives—2

On Making Concrete Road Finishers and Subgraders Do Their Best Work

Lion Gardiner, Vice-President Lakewood Engineering Co., Tells How Sales Are Followed Up by Field Inspection and Constructive Suggestions on Operating Methods.

A PERUSAL of the various state highway specifications for concrete roads issued during the past five or six years indicates clearly the increased attention which is being given to preparing the subgrade, setting the forms and finishing the concrete. The development of machinery and equipment for doing this work has made possible reduced operating costs for the contractor and at the same time has given the highway departments and the public longer-lived roads. In this movement the Lakewood Engineering Co., of Cleveland, has been active, not only in designing equipment for building better roads, but also in helping contractors operate their plant so as to realize from it the maximum in quality and quantity of work. The result has been the development, by the Lakewood organization, of a definite policy of field service. From Lion Gardiner, vice-president of the company, *Engineering News-Record* has obtained the following notes on how this service functions:

FINISHING MACHINES CAPITALIZE ADVANTAGES OF DRY CONCRETE WITHOUT MATERIALLY INCREASING LABOR COSTS OF SPREADING AND TAMPING

SUBGRADE A VITAL PROBLEM

A completed subgrade upon which the side forms are set is in effect a mold or form to contain the concrete and produce an accurate concrete slab in the same sense that metal or wood forms on monolithic concrete construction produce a column, lintel or arch. Strength and accuracy of this mold or form, both from the standpoint of the highway department and the contractor, are essential.

"A manufacturer of equipment used in forming this mold," said Mr. Gardiner, "has a two-fold responsibility: First, to produce a machine which operates to give the results desired; and, second, to teach its use and function so that the contractor may produce in the finished work and in an economical manner the qualities of road surface and slab required by the specifications. The service on the operation of Lakewood equipment begins with the sale. Our salesmen must know not only the advantages of the finishing machine, subgrader or road forms, but bust also be thoroughly acquainted with the limitations in operation of any unit. The sale of a machine for a job necessarily imposes a responsibility for satisfactory operation."

For instance, the sale of a road-finishing machine necessitates making sure that the road forms which will carry the machine are substantial and that the soil upon which they will be set has the proper bearing power to hold them in alignment under the action of the finisher or subgrader. Further, such a sale, as interpreted by Mr. Gardiner, means that if there are any local conditions on the job which would work against the satisfactory operation of the finisher in any way they should be pointed out to the contractor by the manufacturer's representative so that, if necessary, correction can be made.

The responsibility of furnishing road-

building equipment which fails to perform satisfactorily at a critical time, thereby holding up the job and allowing the contractor's overhead expense to pile up at a tremendous rate, is a large one. This responsibility is further increased by the fact that the construction season in most localities is short—scarcely more than 100 working days a year—and time lost due to faulty operation of equipment cannot be regained.

Furthermore, it is the Lakewood company's experience that the servicing of road-building equipment is complicated because the contractor's organization is often not a stable one. Since the construction season lasts only part of a year the organization has to be broken up at the close of the season and the operators of the various machines are frequently changed as a result.

Checking Up On Operation

"The continued and increased sale of our equipment," Mr. Gardiner continued, "depends upon its satisfactory performance, and to insure such satisfactory performance under the conditions outlined we keep on the road during the active construction season field men whose duty it is to check up the operation of our units. This inspection is rendered not only at the request of an individual contractor, but is systematically made so that we have a fairly accurate record of the performance of all of our equipment in any territory.

"These inspectors visit the work and advise the operator and the contractor concerning the use of the machine, its adjustment, or repair. Besides having contact with the contractor and his men in charge of the equipment, our inspectors are also in touch with the engineers of the highway department and its inspectors. Thus we are assured that the requirements of the contractors and the State are being met.

"When such an inspection has been completed our man obtains the signature of the superintendent or the contractor himself, if possible, to an inspection report showing satisfactory operation of our equipment, and setting forth any suggestions which our man may have made for better operation. One copy of this form goes to the contractor's home office and another is sent to the state engineer in whose district the work is located as an indication to both that our interest in the equipment has not ceased with its sale.

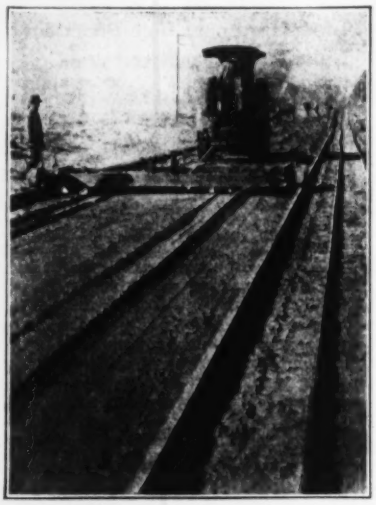
"Aside from this provision of field service, every effort is made, whenever there is opportunity for mechanical improvement of the machines, to make the new parts interchangeable with the old, so that early model machine owners may benefit with new users."

The functions of the three units—finisher, subgrader and forms—are so closely related that service problems overlap. Nevertheless, in the following notes, an attempt is made to segregate and discuss the more important problems of each of these units:

The Finishing Machine

In so many states do the specifications require the finishing machine, because of the added strength and density of the concrete, that the Lakewood organization regards its responsibility as a double one, to the highway department and to the contractor. A concentrated and specific service, therefore, is insisted upon.

Mechanical finishing machines have made possible the use of drier concrete, with its attendant advantages of greater strength and density without increasing materially the labor cost of spreading, tamping, and finishing. Mechanical finishing machines, however, cannot produce a road surface more accurate than the side forms upon which they run. Specifications for road construction lay emphasis upon the smoothness of the surface, and require it be tested with a straight edge to detect any appreciable variation. High or low spots may be the cause of the rejection of part



Machine-Made Subgrade Forms Accurate Mold for Concrete

of the work, or may make it necessary for the contractor to spend additional time in correcting them. It is essential, therefore, that the side forms be properly set, and particular emphasis is placed upon this point, not only by the manufacturer's field service men but also by his salesmen.

When a finishing machine is shipped to a contractor there is included with it a printed instruction book based upon the company's five years' field experience with this unit. This book contains information as to the assembly of the machine and its operation, and in addition tells about troubles which may be caused by lack of adjustment, the remedy and the lubrication of the machine. It gives pointers on the care and storage of the equipment during the winter months. Photographs and drawings are used to illustrate instructions, and bring out the points to be emphasized. It is realized that the operators of these machines will not have the time nor the inclination to study from a printed page the necessary steps in assembly, operation or adjustment. Therefore, the printed matter is kept to a minimum and consecutive steps are shown by pictures.

In addition to sending such an instruction book to the job with the machine, another copy is sent at the time of shipment to the home office of the contractor, so that the information will reach the contractor himself as well as his operator. The points in this instruction book are reiterated by both the Lakewood company's field-service men and its salesmen, who also make it a point to visit the job in operation after the equipment is sold. Some of these important points are:

1. Set your forms well, and see that there is a good foundation for them.
2. Some hand spreading must be done ahead of the strike-off of the machine, as it is not possible for the finisher to spread a bank of 6 in. or more of concrete ahead of it without causing unevenness in the road.
3. Control the water supply on the mixer so that batches are maintained at a uniform consistency.
4. When placing concrete on grades uniformity of mix is of even more importance than on level work, because upon it depends the smooth-riding surface that must be obtained.
5. Clean the concrete off the machine at night. Do not allow 200 or 300 lb. of concrete to collect on the strike-off and tamping members.
6. Lubricate thoroughly.
7. A set of important spares is sent with the machine, and when one is used see that it is replaced immediately to avoid any possibility of a delay in your work.
8. Keep the float belt clean and flexible.
9. Check the finished work frequently to see that the desired results are being obtained. With some consistencies of concrete it is necessary to set the strike-off blades higher or lower than for others.

In addition to the foregoing points attention is directed to the use of the machine on pavements built under modified or changed specifications. For instance, the practice of building roads in half-widths brought about a specific problem to be met with the finisher. This was done by providing a special set of wheels to be used when finishing the second half of the road. The first slab is finished as any standard pavement. For the second slab the outside wheels of the finisher run on the road form, and are doubleflanged. The inside wheels run on the first slab and are flat tread. The working out of this method for best results means that the manufacturer's service men must be thoroughly posted upon its application and any special problems to be encountered.

The Subgrader

The function of the mechanical subgrader is to plane or trim the subgrade to the final cross-section required, and upon its proper functioning depends the accuracy with which the road slab conforms to the specifications. The subgrader travels on the side forms, and the same necessity of seeing that they are well set obtains as for the finisher. The variety of soils upon which the subgrader is used requires that field men know how such different soils should be handled. With some it may be necessary to sprinkle the subgrade before the final cut is made. With others such sprinkling might be a detriment rather than a help. Speaking of practical points in subgrader operation Mr. Gardiner said:

"The subgrader is intended primarily for the final fine grading, but often the

men on the job, seeing how ruggedly the machine is built, attempt to take cuts which are entirely too deep. Considering an 18-ft. road a cut ¼ or ½ in. deep for its full width produces considerable material to be removed or drifted to the low spots. Very often it is found that the contractor is not obtaining full advantage of his subgrader because he is attempting to take his first cut too deep. The subgrader serves as a marking templet to indicate high and low spots, and makes for efficiency in moving earth from the high to the low spots if the first cut is not too deep.

EQUALIZING CUTS AND FILLS

The operation of the subgrader for the first time so that the blades will cut the top of the high spots will indicate immediately where fills must be made. If the cut is too deep this advantage is lost. Further, moving the material which is cut from the high spots to the low spots on the subgrade makes it unnecessary to bring in material from outside the forms. With the low spots filled and rolled the function of the subgrader is to plane the subgrade ½ in. at a time, if necessary, until it conforms to the required depth at all points. To get full advantage from the subgrader it is also necessary that forms be set well ahead of where concreting is in progress, so that a sufficient amount of subgrade can be completed at one operation."

Some instances are found by Lakewood service men where contractors owning subgraders are not using them because they do not appreciate the fact that this tool can be used in conjunction with motor-truck haul of materials without stopping operations. "Very often," Mr. Gardiner continued, "it is possible to use a subgrader in the morning, at noon and in the evening, when hauling is not in progress, so that sufficient subgrade can be completed for the entire day's run. Then there are some instances where instructions are given about moving the subgrader to one side of the road, after it has completed its operation, so as to clear the right-of-way for the trucks. Even the method of handling such a simple operation may mean a saving to the contractor. Our men are very often able to demonstrate on a job the advantage of carrying two short timbers upon the subgrader upon which it is lowered and moved to one side of the road when it is desired out of the way.

"The length of hitch used has considerable influence upon the results obtained. Too short or too long a hitch will cause difficulty in side play, with resulting damage to forms. We, therefore, furnish with the machine the proper length cable to be used and our service men keep the contractor posted on this point."

ROAD FORMS

The advent of mechanical finishing of the subgrade and the mechanical finishing of the surface of the concrete slab, has increased the importance of proper setting of the forms. They have become not only the mold for the side of the slab, but a templet from which the subgrader shaves the subgrade to the proper depth and the finisher strikes off, tamps and belt-floats the concrete to the proper height. Accordingly, a firm foundation for road forms is infinitely more important than before, as low spots at the joints or in the forms will immediately reflect irregularities in the subgrade and the surface of the road. Service on road forms has to do primarily with seeing that they are properly staked and properly aligned.

Manufacturers during the past year have doubled not only the thickness of road forms to get strength, but also have increased the width of the form base to give added bearing surface. It devolves upon the contractor, Mr. Gardiner believes, to prepare the grade to receive these forms so that the required accuracy is maintained and a good support given to bear the weight of the subgrader and finishing machine.

Not only has Lakewood's field service had to do with the proper setting of forms, but the company's engineering department has spent considerable time in the development of its own form and the study of the service which it must meet. In an effort to insure the rigidity of the forms the company has manufactured sections 12-ft. in length against those of 10 ft. ordinarily sold, thereby reducing the number of joints required. Experience has further developed a round-top or line-point surface form upon which the concrete cannot lodge to cause irregularities in the surface of the road as the finishing machine goes over them.

"To sum up," Mr. Gardiner concluded, "it is the policy of our company to see to it that equipment is sold only with the proper understanding on the part of the contractor as to its performance, and that after the sale is completed full and sufficient instructions are given either by printed books, correspondence or personal visits to the end that the units function to the entire satisfaction of all concerned."

To Manufacturers of Machinery and Materials

You received from "Engineering News-Record" last week a letter requesting a brief statement covering the outstanding improvements made in your products during 1923.

This information is desired for the

Annual Review of Machinery and Materials

to appear in the first issue of the New Year, Jan. 3, 1924.

It is important, if the developments in your machines or materials are to receive adequate editorial treatment, that you send us the information desired as soon as possible—in any event not later than Dec. 17.

Paving Brick Shipments Continue Heavy

That the paving season because of a wet spring generally and a late start, is running later in the fall this year than is customary is indicated by the continued heavy shipments of vitrified paving brick reported by the National Paving Brick Manufacturers Association. Shipments for the month of October were 34,287,000 brick as against 34,761,000 for September. The total number of brick manufactured was 34,317,000 for October and 34,457,000 for September.

Sanction Sought for Joint Sales Organizations

Movement on Foot to Amend Webb Act —Initial Action on Construction Materials Probable

Washington Correspondence

WHILE it is too early to predict what concrete action will be taken by industy following the discussion at the Department of Commerce of selling combinations, it is known that much interest is being manifested in the general question. Definite steps are expected shortly because of the need for prompt action if economies are to be effected in handling reconstruction sales in Japan. The time also is opportune to secure an amendment to the Webb-Pomerene act, if it should be found desirable to organize under that statute.

The agitation at this time for joint sales organizations or selling corporations comprised of non-competing units is more than an effort to handle Japanese business in the most effiecient way. It is being considered in connection with the movement to expand all of our export activities. It is recognized that all possible economies must be secured if we are to compete in the world markets.

MAY AMEND WEBB ACT

Joint sales organizations can be established abroad by non-competing industries without legislation. There are some who believe, however, that advantages would accrue were it possible to organize non-competing activities into Webb law corporations. It is known that the Webb act is to be taken up for amendment at this session of Congress. The principal amendment which will be proposed is to permit of combinations for import purposes. These combinations doubtless will be limited to commodities produced entirely or in great part abroad, in the handling of which artificial price levels are maintained.

While many industries are interested in these proposals, the first definite step is likely to be taken by the manufacturers of construction materials. It is evident that important economies could be effected were sales of lumber, steel, sash, doors, plumbing, glass, paint and other building materials handled through the same agency. If organization along those lines expedites and makes more efficient the handling of the Japanese orders at this time, it is argued that it should be equally useful in handling other export business.

In the export trade American manufacturers are having to meet competition from countries where it is entirely legal to combine. The depression in Great Britain is forcing large-scale combinations, which mean reduced overhead charges and the elimination of the less efficient production units. One of the principal savings is in selling costs. Knowledge and experience in manufacture can be pooled. Research can be undertaken on a more ambitious scale.

While American manufacturers may not take advantage generally of many of these economies by reason of our anti-trust statutes some of them can be secured in the handling of exports. It is believed that Congress is disposed to consider sympathetically various amendments to the Webb-Pomerene Act.

"Commerce Yearbook" Presents Survey of American Industry

A new government service to business has just been made available in the form of the "Commerce Yearbook," prepared by the Department of Commerce to meet demands of American business men, bankers, economists and trade association executives for an authoritative review of the economic year throughout the world from the point of view of American industry. The first issue covers the year 1922 and the early part of 1923. It comprises 692 pages, containing, in addition to the text, many charts, maps and tables of statistics.

The book is intended not merely as a reference source but to be read for general commercial information on such outstanding facts of trade as production, price changes and market conditions. Among the chapters dealing with the nation's important industries is one on the "Construction Industry."

Business Notes

LAKEWOOD ENGINEERING CO., Cleveland, manufacturer of concrete chuting equipment, steel road forms, subgraders and finishing machines, announces that the sale of its equipment has been placed in the hands of Brown & Sites, 30 Church St., New York, N. Y. From 1912 to 1918 this company handled the Lakewood line of construction and paving equipment in the New York territory, so that, in resuming this representation, the Brown & Sites Co. has full knowledge of Lakewood products and policies. Special attention will be devoted to giving service to contractors who purchase this equipment.

Equipment and Materials

Imported Trass Available in U. S.

Recent importations from Germany now make available for the first time on a commercial scale in the United States supplies of trass, a mineral product of volcanic origin which, when mixed with portland cement, is claimed to produce concrete exceptionally hard, watertight and resistant to acid and sea-water. The material has been extensively used for years past in European practice for concrete dams, pipe and structures in sea water. The distribution of trass in the United States is being handled by Emil Stahl, 531 Palisade Ave., Jersey City, N. J.

Publications from the Construction Industry

Snow Plows—GOOD ROADS MACHINERY CO., INC., Kennett Square, Pa., has issued an illustrated 7-p. bulletin on its Champion snow-plows for attachment to the front ends of heavy tractors. The plow consists of an inclined platform carried on rollers and sleds with a V-type moldboard mounted on it on a push frame arranged for attaching to the tractor.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 305 to 320, are the following:

School, New York, N. Y., to G. Colon & Co., $1,089,000.

Apartment Hotel, St. Louis, Mo., to P. J. Bradshaw, $1,500,000.

Factory, Rocky Hill, Conn., to Dennis O'Brien & Sons Co., $1,000,000.

Apartment, New York, N. Y., A. D'Antona by day labor, $1,000,000.

Apartment, New York, N. Y., to Turner Constr. Co., $1,000,000.

Winter Building Advocated

That the usual summer shortage of skilled building trades mechanics is becoming more pronounced each year, is the opinion of Monks and Johnson, architects and engineers, of New York and Boston.

"Each spring and summer," they point out, "see contractors offering inducements in the form either of premium wages or assurance of overtime at the regulation rate in order to secure workmen. There is little or no opportunity to select artisans for the quality of their workmanship. All are employed and all are eagerly sought by employers. Inefficiency abounds and costs mount high.

"In the winter, however, there is unemployment. A chart recently published by the Boston Building Congress gives the percentage of employment during the months of December, January and February as follows:

Trade	Per Cent
Common labor	40
Carpenters	50
Masons	25
Lathers	40
Plasterers	50
Painters	25

"Experience has shown that winter building is possible, and in most kinds of construction without sacrifice of quality. There remain therefore only considerations of economy. It would cost more to build in winter, were other factors the same, than in the warmer months. Materials must be heated and protection provided to prevent fresh concrete and mortar from freezing. Numbed fingers are not nimble. Snow must be removed. There is a well recognized additional expense involved in these factors. But there are factors on the other side.

AMPLE SUPPLY OF LABOR IN WINTER

"In the winter there is ample supply of labor. Wage premiums and overtime assurances are unnecessary. Selection of artisans is possible and competition spurs them to greater efforts. The market for building materials almost invariably eases up in the late fall and winter. Shrewd purchasers can buy for midwinter delivery substantially below spring and summer prices. Contractors anxious to keep their organizations functioning and thus meet the cost of that bugaboo of business executives, overhead, are often glad to forego in the winter months further profit. These factors all favor winter building and may balance or outweigh the cost of heating and protection."

Next week—Production and stocks of basic buildng materials in several important centers.

Business Briefs

Call money easier at 5@4½ per cent.

Time money quiet and unchanged at 5@5¼ per cent.

Commercial paper unchanged at 5@5¼ per cent.

Foreign exchange advances and then declines. Sterling, $4.34⅜; last week, $4.38¼; year ago, $4.53¾. Franc, $0.0540½; last week, $0.0545¾; year ago, $0.0702¼. Lire, $0.0434; last week, $0.0435; year ago, $0.0501½.

Common Brick Imports Increase

A total of 18,365,000 common brick was imported into this country, through the Port of New York, during the third quarter of the current year, as against 10,379,000 for the preceding quarter.

In *Engineering News-Record*, issue of Nov. 29, p. 911, the import total for the first quarter was incorrectly stated at 10,379.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 305 to 320, are the following:

Bank and Office, Dallas, Tex., Republic Nat'l Bank, $1,500,000.

Apartment, Chicago, Ill., R. W. Matteson, $1,000,000.

Ties, Montreal, Que., Canadian Pacific Ry., 6,000,000 ties $4,000,000.

Mill, Temiskaming, Que., L. N. Huard, $1,000,000.

Hotel, Memphis, Tenn., Southern Hotel Co., $3,000,000.

Bank and Office, Buffalo, N. Y., Liberty Bank, $2,000,000.

Hotel and Office, Philadelphia, Pa., Middle City Realty Corp., $10,000,000.

Foreign Projects of Interest to Americans

A number of foreign construction projects which should be of interest to American engineers, contractors and manufacturers has been reported by the United States Department of Commerce. They are noted here, further information being available at the Bureau of Foreign and Domestic Commerce or its district co-operative offices, when a reference number is given.

Water for two Greek cities from artificial lake. Specifications are now available for examination by interested American firms. Reference No. 12,599.

Modern hotel for Czechoslovakia. Hotel along American lines to be erected in Prague. Estimated cost, $2,500,000. Reference No. 12,558.

Subway to be built in Argentine city. A street car company plans to build a subway to take care of heavy business traffic. Reference No. 35X-A.

Power station to be built at Guadeloupe. Plant to furnish power for chocolate factory and light for two neighboring sections. Reference No. 111,348.

Value of November Contracts 16 Per Cent Heavier Than for Same Month Last Year

Total of 795 Awards During November, Average Value $196,402, Compared With 699 in October, Averaging $230,724

The total value of contracts awarded on large engineering construction projects, in the five November issues of *Engineering News-Record*, reached $156,140,000 as compared with $161,276,000 in the four issues of October. This represents an average weekly value of $31,228,000 for November, against $40,319,000 during the preceding month.

The weekly average of $31,228,000 for the month of November represents an increase in money value of nearly 16 per cent above the weekly average for the corresponding period in 1922.

Minimum costs observed in Construction News on each class of construction are as follows: Waterworks, $15,000; other public works, $25,000; industrial construction, $40,000; and commercial buildings, $150,000.

All classes of construction fell off during November with the exception of water-works, bridges, excavations, commercial buildings and certain unclassified jobs. Water-works awards gained 72 per cent in total money value during the month, while bridges increased 42 per cent and commercial buildings, 20 per cent. Contracts awarded for excavations, drainage and irrigation, totaling $2,749,000, were over three times greater than those for the preceding month.

Among the large projects awarded during October were the following: A central station at Davenport, Ia., $10,000,000; bank and office building, Cleveland O., $5,000,000; 5,000 tons of steel for shipping terminal, Seattle, Wash., $4,000,000; filtration plant, Cleveland, O., $2,885,000; hotel, Louisville, Ky., $2,300,000; and a high school, New York, N. Y., $2,145,000.

Engineering News-Record Construction Cost Index Number

December, 1923	217.30
November, 1923	220.90
December, 1922	192.60
Peak, June, 1920	273.80
1913	100.00

Engineering News-Record's Construction Cost Index Number dropped 3.6 points since last month, owing to decline in prices of lumber and cement. Prices of other basic building materials remained unchanged during the month. The average rate for common labor is still 54c. Thus, general construction cost is 13 per cent higher than one year ago and 21 per cent under the peak; it is 117 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

Monthly	
November, 1923 (*5 issues of E. N.-R.*)	125
October, 1923 (*4 issues of E. N.-R.*)	127
November, 1922 (*5 issues of E. N.-R.*)	122
1913	100
Yearly	
1922 (entire year)	130
1921 (entire year)	88
1920 (entire year)	91
1913	100

Engineering News-Record's Construction Volume Index Number is 125 for the month of November, and 130 for the whole of 1922, as against 100 for 1913. This means that the actual volume of construction in 1922 (not the mere money-value of the contracts let that year) is 30 per cent above the volume of construction for 1913. Our monthly volume number, 125 for November, 1923, is really the increment of construction, and indicates the rate at which contracts are being let as compared with 1913 awards.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING NOVEMBER, 1923

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	Western	Total United States	Canada	Grand Total
Waterworks	$89,000	$328,000	$218,000	$3,436,000	$1,656,000	$507,000	$6,234,000	$30,000	$6,264,000
Sewers	58,000	421,000	24,000	1,225,000	1,358,000	368,000	3,454,000	133,000	3,587,000
Bridges	216,000	544,000	1,247,000	829,000	441,000	2,507,000	3,486,000	.....	4,678,000
Excavations, drainage and irrigation	.....	.....	249,000	25,000	895,000	676,000	2,674,000	75,000	1,557,000
Streets and roads	612,000	2,184,000	6,408,000	4,188,000	6,015,000	4,099,000	23,506,000	177,000	23,683,000
Industrial works	705,000	2,665,000	840,000	6,700,000	12,407,000	1,724,000	25,041,000	415,000	25,456,000
Buildings	2,320,000	27,951,000	8,026,000	15,688,000	8,455,000	8,324,000	70,764,000	998,000	71,762,000
Federal Government	80,000	905,000	1,084,000	391,000	1,032,000	820,000	4,312,000	.....	4,312,000
Unclassified	150,000	3,669,000	874,000	324,000	2,534,000	407,000	7,958,000	2,368,000	10,326,000
Materials and equipment	.....	238,000	.....	25,000	46,000	4,206,000	4,515,000	.....	4,515,000
November, 1923	$4,230,000	$38,905,000	$18,970,000	$32,831,000	$34,839,000	$22,169,000	$151,944,000	$4,196,000	$156,140,000
October, 1923	4,958,000	55,001,000	18,435,000	38,573,000	15,924,000	24,855,000	157,746,000	3,530,000	161,276,000
September, 1923	6,585,000	40,893,000	20,757,000	39,116,000	32,055,000	27,534,000	166,940,000	6,132,000	173,072,000
Total 3 months	$15,773,000	$134,799,000	$58,162,000	$110,520,000	$82,818,000	$74,558,000	$476,630,000	$13,858,000	$490,488,000

Labor Rates and Conditions Throughout the Country

Wage increases reported during November were far in excess of reductions despite the seasonal slowing down in construction, the marked curtailment in the cotton textile output and a decrease in bituminous coal production. The advances occurred principally among steam and electric railway employes and in the printing industry.

Increased wages and higher living costs, particularly in food, clothing and fuel, are contrasted with the perceptible slowing down in general industrial activity. Proposed legislative action affecting tax reduction; soldiers' bonus; child labor; railroad, agricultural and immigration problems, is one of the principal factors governing the present state of industrial uncertainty.

An increased pig iron demand, however, stands out as the most favorable factor in the whole business situation.

The average rate paid common laborers (pick and shovel men) in construction operations has remained at 54c. during the last six months; the June rate being 53c. per hr., according to *Engineering News-Record* figures. Local conditions are as follows:

Atlanta—Small demand for building trades mechanics within city; construction active in outlying districts.

Baltimore—Conditions normal in building trades with possible exception of structural iron workers and common laborers.

Birmingham—Structural iron workers now receiving maximum of $1 per hr., against $1.25 formerly. Men employed on municipal jobs being paid the lower rate.

Boston—Building trades mechanics plentiful; all classes. Carpenters, however, receive maximum rate of $1.10, compared with $1.05 per hr., on residential construction work.

Cincinnati—New carpenters' union formed under auspices of Building Trades Council, due to dispute between carpenters and sheet metal workers. Wage scale still $1.05 per hr.

CURRENT BUILDING TRADES WAGE RATES PER HOUR

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.90	$0.70	$0.50	.....	$0.75	$0.30@.35
Baltimore	1.50	1.00@1.12½	.90	.87½	$0.65	.80@1.00	.30@.50
Birmingham	1.00	1.00	.50@1.00	.30@.40	.....	1.00	.30@.40
Boston	1.25	+1.00@1.10	1.25@1.35	.82½	1.05	1.12½	.60@.75
Cincinnati	1.25	1.05	1.05	.82½	1.05	1.05	.45
Chicago	1.25	1.15	1.00@1.25	.88¾	1.10	1.25	.82½
Cleveland	1.40	1.25	1.25	.87½	1.00	1.10	.87½
Dallas	1.50	1.00	1.00	.40	.87½	1.00	.30@.50
Denver	1.37½@1.50	1.12½	1.12½@1.18¾	.75@.81¼	1.00	1.15⅝	.35@.55
Detroit	1.12½	.80	.80@.90	.50@.60	1.00	.60@.80	.50
Kansas City	1.37½	+1.12½	1.00	.87½	1.00	1.00	+.40@.60
Los Angeles	1.25	.87½@1.00	.87½@1.00	.62½	.....	1.00	.50
Minneapolis	1.12½	.87½	.87½	.71½	.....	.87½	.50@.55
Montreal	.90	.65	.50	.35	.50	.65	.30
New Orleans	1.25	.90	1.00	.65	.80	1.00	.35@.40
New York	1.50	1.25	1.25@1.50	1.00	1.00	1.25	+.62½@.75
Philadelphia	1.50	1.12½	1.02½@1.13½	.70@1.00	1.00	1.10@1.12½	.45@.50
Pittsburgh	1.40	1.20	1.12½	1.00	.....	1.25	.70
St. Louis	1.75	1.50	1.25@1.37½	1.25	1.25	1.25@1.50	.45@100
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.25	1.00	1.00@1.12½	.93¾	1.00@1.12½	1.12½	+.62½

Dallas—Excessive demand for bricklayers and carpenters; ample supply of other trades.

Detroit—Release of men from manufacturing plants has supplied needed labor for construction work. No shortage in any of the building trades.

Kansas City—Carpenters advanced 12½c. per hr. since last month. Minimum rate for common laborers 40c. as against 35c. per hr., formerly.

Montreal—Ample supply of all crafts.

New York—The old Building Trades Council with a membership of about 100,000 men, demand a wage increase of $1 per day for a period of two years, beginning Jan. 1. Present base pay of $9 per day, with a bonus of $1, making $10, would be advanced to a base pay of $11 should this demand become effective.

Philadelphia — Sufficient building trades mechanics to meet all demands. Surplus of common laborers. Maximum rate for hoisting engineers $1.13½ as compared with $1.02½ per hr. formerly.

Pittsburgh—Building labor plentiful; demand "eased off" during last few weeks.

St. Louis—No change in present building trades wage schedule. Lathers have served notice that they will ask $15 for an 8-hr. day on March 1, the largest wage ever reached in St. Louis under a contract. Bricklayers and plasterers now receive $1.75 per hr. with some talk of asking $2 with a 5-day week. Electrical workers, carpenters, elevator constructors, plumbers and steam fitters get $1.50 per hr., with individual workers being paid bonuses above that amount.

San Francisco—Building trades well employed.

Seattle—Plasterers on strike for $10 @$12 per 8-hr. day. Two large jobs, however, are paying $11 per day; most other jobs non-union.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Pig Iron—November iron sales reached million ton mark. Present low iron prices may rise to meet steel or latter may tend downward in the direction of iron quotations. No. 2 foundry iron, $22 at Birmingham, against $24 per ton one year ago.

Railway Supplies—Minimum on light rails up $2 per ton at Pittsburgh mill, during month; present price $2@5 per ton above year ago. Standard spikes down in San Francisco; track bolts lower at Pittsburgh mill.

Pipe—Wrought pipe demand largely confined to butt weld sizes in small tonnages. April 19 basing card still in effect at Pittsburgh. Cast-iron pipe slightly lower than month ago in New York; over $7 per ton higher than one year ago. Sewer-pipe and clay drain tile firm at present levels.

Road and Paving Materials—Downward trend in Mexican asphalt in Boston and Atlanta. Road oils unchanged. Average daily crude oil production declining.

Sand, Gravel and Crushed Stone—Sand down about 5c. per cu. yd. in Cincinnati and Atlanta. Gravel declined 10c. per ton in Atlanta and rose 25c. per cu.yd. in New York, during month. Crushed stone down 10c. per ton in Atlanta.

Lime—Hydrated lime declined in Boston and Atlanta; lump lime in Atlanta, Dallas and Detroit. Common lump, however, advanced 20c. per bbl. in Boston.

Cement—Reduction of 10c. to 25c. per bbl. at various mills throughout the country. Drop reflected in dealers quotations. Owing to change in freight rates in Illinois and Wisconsin, effective Nov. 24, price at Peoria, dropped from $2.41 to $2.27 and at Milwaukee from $2.37 to $2.25 per bbl. A voluntary downward adjustment in mill prices brought the delivered price, f.o.b. Detroit, to contractors, to a basis of $2.37, against $2.48 last month. These reductions while in part seasonal, were also made to stimulate renewed interest in winter construction.

Structural Steel—Steel bars continue firm at $2.40 per 100 lb., Pittsburgh. Shapes and plates have been quoted as low as $2.40 for large tonnages; small lots or specified deliveries, however, bringing a minimum of $2.50 per 100 lb.

Brick and Hollow Tile—Common brick advanced 50c. in San Francisco and 60c. in Dallas, during month; Boston reports decline of $1 per M., delivered. New York quotations are $19 per M., wholesale, at dock, against $19@$20, one month ago and $15@15.50, one year ago. Hollow tile declined slightly in Philadelphia and Atlanta during month.

Lumber—Output increased 5,016,482 ft.; shipments, 3,298,724 ft. and new business, 6,221,976 ft., for the entire country, during week ended Nov. 24. General price decline in pine, fir, hemlock and spruce. Minneapolis, however, reports rise of $1 per M. ft. in 8-in. Douglas fir timbers.

Explosives—Advance of 1c. in Boston and decline of ¼c. per lb. in Atlanta, on 60 per cent gelatin dynamite.

Scrap—No. 1 machinery cast and heavy melting steel up $1 per ton in New York.

Linseed Oil—Raw oil 95c. f.o.b. New York, against 98c. per gal. (5 bbl. lots) one month ago. Declines reported in Chicago and San Francisco; slight rise in Minneapolis.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	Dec. 6	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	*$25.05*	$27.55
Northern Basic	*24.00*	30.27
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	*24.00*	30.27
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	*28.00*	35.27
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	*22.00*	24.00
PHILADELPHIA		
Eastern Pa., No. 2X, (2.25@2.75 sil.)	24.25	31.64
Virginia No. 2 (silicon 2.25 @ 2.75)	28.17	37.17
Basic	*24.00*	27.50
Gray Forge	*24.00*	29.14
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	*24.50*	30.00
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	*27.00*	30.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	25.77	27.50
Basic	25.77	27.50
Bessemer	26.77	30.50

SCRAP—The prices following are per gross ton paid to dealers and producers f.o.b. New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	St. Louis
No. 1 railroad wrought	$15.00	$11.50	16@16.50
Stove plate	12.00	12.00	16.00
No. 1 machinery cast	**17.00**	16.50	19.50@20
Machine shop turnings	8.00	4.00	12.50@13.50
Cast borings	9.00	5.50	14.00
Railroad malleable	15.00	12.50	21.00
Re-rolling rails	13.00	13.00	21.50@22
Re-laying rails		30.00	28.00@31
Heavy melting steel	**12.00**	16.00	

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	Dec. 6	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	.....	$43.00	$43.00
Standard openhearth rails	43.00	43.00	$43.00	43.00	43.00
Light rails, 8 to 10 lb.	**45.00**	40@43	2.00*	43.00	43@45
Light rails, 12 to 14 lb.	**45.00**	40@43	2.00*	43.00	43@45
Light rails, 25 to 45 lb.	**45.00**	40@43	2.00*	43.00	43@45
Rerolled Rails	37@**40**	28@32	.....	.....	.....

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	$1.70	$1.90
Chicago, Hardwood and Red Oak	1.35@1.45	1.50@1.70
Chicago....Empty Cell Creosoting (add'l)	.50	.60
San Francisco..... Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted Douglas Fir	1.70	2.25
St. Louis, White Oak	1.30	1.60
St. Louis (creosoted) (zinc treated)	1.70	2.05
St. Louis, Red Oak, plain	1.20	1.50
St. Louis, Sap pine-cypress	1.05	1.35

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh						
	Dec. 6	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$3.15	$2.75	$3.00	$4.00	*$4.85*	$3.72
Track bolts	*4.00*	3.85@4.50	4.00	5.05	6.20	4.57
Standard section angle bars	2.75	2.75	2.75	4.00	4.00	3.20

PIPE

WROUGHT PIPE—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	1 to 1¼	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	1 to 1¼	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	48%	50%	49%
2½ to 6 in. lap welded	44%	47%	46%
	Galvanized		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	34%	37%	36%
2½ to 6 in. lap welded	30%	34%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

			New York	
	Birmingham Mill	Pittsburgh	Dec. 6	One Year Ago
4 in.	$53.00	$60@65	*$67.10@68.60*	$59.30
6 in. and over	49.00	56@60	*62.10@63.60*	54.30

	Chicago	St. Louis	San Francisco
4 in.	$60.20@64.20	$61.60	*$63.00*
6 in. and over	57.20@60.20	57.60	*59.00*

Gas pipe and Class "A," $5 per ton extra; 16-ft. lengths, $1 per ton.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

	New York					
Size, In.	Dec. 6	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$45.00	$45.00	$50.00	$62.50	.....	$73.00
4	55.00	55.00	50.00	75.00	$76.50	83.00
5	80.00	80.00	85.00	100.00	97.75	108.00
6	105.00	105.00	85.00	175.00	127.50	133.00
8	170.00	170.00	195.00	187.50	212.50	199.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	$0.105	.....	.....	$0.15	$0.12	.....
4	.....	.105	$0.11	$0.1175	.15	.15	$0.15
5	.....	.1575	.1375	.....	.23	.18	.18
6	$0.24	.1575	.165	.1645	.23	.21	.21
8	.38	.245	.26	.26	.35	.30	.325
10	.57	.3675	.338	.338	.53	.42	.476
12	.72	.4725	.442	.468	.68	.54	.612
15	1.13†	.63	.65	.78†	.90	.90	.884
18	1.65†	.875	.85	1.092†	1.25	1.32	1.153
20	1.98†	1.05	1.125	.....	1.50	.....	.....
22	2.64†	1.40	1.375	1.456†	2.00	.....	1.564
24	2.97†	1.575	1.625	1.872†	2.25	2.16	2.04
27	4.81†	2.795	.....	2.95†	4.69†	3.00	3.34
30	5.33†	3.096	.....	3.65†	5.94†	3.60	4.06
33	6.93†	4.14	.....	4.45†	6.88†	.....	4.99
36	7.91†	4.715	.....	4.80†	7.50†	.....	5.42

	3	5	8	12	24	36
Boston	$0.131	$0.202	$0.32	$0.612	$2.05†	$6.15†
Minneapolis	.....	.....	.40	.72	2.55	5.66†
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	.13	.....	.36	.72†	2.60†	.....
Los Angeles	.13	.165	.275	.475	1.65	.....
New Orleans	.145*	.168*	.28	.476	1.182	.....
Cincinnati	.12	.18	.28	.54	1.80	4.10†
Atlanta	**.11***	**.165***	**.275**	*.425*	*1.625*	.....
Montreal, *delivered*	.68‡	.45†	.70	1.35	4.50†	.....
Detroit	.117	.1755	.273	.5265	2.34†	6.15†
Baltimore	.117	.175	.273	.5265	1.755	3.9975
Kansas City, Mo.	.15*	.21*	.332	.....	.....	.....
Philadelphia	.12	.18	.28	.54	1.80	5.225

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		Dec. 6	One Year Ago
New York, 45% asphalt	(at terminal)	$0.053	$0.06
New York, 65% asphalt	(at terminal)	.052	.06
New York, binder	(at terminal)	.06	.0675
New York, flux	(at terminal)	.06	.065
New York, liquid asphalt	(at terminal)	.048	.07
St. Louis, 50@60% asphalt		.055	.07
St. Louis, 40@50% asphalt		.053	
Chicago, 40–50% asphalt		.0525	.0525
Chicago, 60–70% asphalt		.055	.055
Dallas, 45% asphalt		.0495	.04
Dallas, 55% asphalt		.0455	.048
Dallas, binder		.061	.053
San Francisco, binder, per ton		9.50*	9.50*

* F.o.b. Oelum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbl. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Texas*)	$23.00*	$15.00†
Boston (*Mexican*)	22.00	*17.00*
Chicago (*Stanolind*)	22.25	16.00
San Francisco, *f.o.b. refinery*, Oleum, Cal	17.00	11.00
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond*	24.75	20.50
Denver (*California*)	24.00	...
Minneapolis *f.o.b. Twin Cities* (*Stanolind*)	25.45	19.10
St. Louis (*Mexican*)	29.50	24.50
Baltimore (*Standard Oil*)	18.00	14.00
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	*24.00*	*21.50*
Detroit (*Mexican*)	22.00	18.00
Cincinnati (*Kentucky Rock*)	17.50	13.50
Maurer, N. J. (*Bermudez*)	28.00	26.00
Maurer, N. J. (*Mexican*)	21.50	18.50
Philadelphia (*Mexican*)	19.00	16.00
Kansas City (*Texas*)	23.30	27.30
Los Angeles "*D*" *grade. California, f.o.b. El Segundo Refinery*	17.00	11.00

*F.o.b. Bayonne, N. J.
†F.o.b. Marcus Hook, Pa.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade 1)	5-in. granite, 30 blocks per sq.yd.	$140.00 per M.
Chicago	About 4x8x4 dressed	3.60 per sq.yd.
	About 4x8x4 common	3.20 per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	130.00 per M.
Atlanta	Granite	2.66 per sq.yd.
Detroit	5-in. Granite	106.00 per M.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4 x 8 x 4	3.25 per sq.yd.
Cincinnati	Granite	138.00 per M.
St. Louis	4x8x4 dressed	3.05 per sq.yd.
	4x8x4 common	2.90 per sq.yd.
Kansas City	Granite	per sq.yd.
Philadelphia	Granite	3.75@4.50 per sq.yd
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft wide	$0.22 per sq.ft.
	Manhattan, 4 ft. wide	.22 per sq.ft.
	Queens, 5 ft. wide	.24 per sq.ft.
	6x24-in. cross-walk	1.10 per lin.ft.
Chicago	18 in. wide ... No market	.... per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5 x 16 in., 80c.; 5 x 20 in., Queens, 85c. *St. Louis*: Class "A" straight, delivered, 5 x 16 in., $1.40 per lin.ft. *Chicago*: 5 x 18 in., $3.35 per lin.ft. delivered.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York (*delivered*)	3	16	$2.58
New York (*delivered*)	3½	16	2.79
Boston	3½	18	2.72
Chicago	4	16	3.50
Chicago	3½	16	3.50
St. Louis	3½	16	2.55
St. Louis	4	16	2.90
Seattle	4	16	Off market
Minneapolis	3½	16	2.70
Atlanta	3½	16	1.90
New Orleans	3	16	2.50
New Orleans	3½	16	2.81
New Orleans	4	16	3.15
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	2.84
Detroit	4	16	3.00
Cincinnati	3½	16	2.38
Kansas City	4	16	...
Philadelphia	4	16	None used

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In. Dec. 6	Gravel 1½ In. One Year Ago	Gravel ¾ In. Dec. 6	Gravel ¾ In. One Year Ago	Sand Dec. 6	Sand One Year Ago
New York	$2.00	$2.00	$2.00	$2.00	$1.25	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	2.00	2.25	2.00	2.25	2.00	2.25
St. Louis	2.30	1.45†	2.35	1.50†	2.10	1.45†
Seattle	1.25	1.00	1.25	1.00	1.25	1.00
Dallas	2.38	2.52	2.38	2.52	2.00	1.87½
Minneapolis	1.85*	1.75	1.85*	1.75	1.25	1.00
Cincinnati	1.35	1.40	1.35	1.15	*1.30*	1.15
San Francisco	2.15	2.15	2.15	2.15	1.50	1.50
Boston	1.40†	1.40	1.40†	1.40	1.10†	1.10
New Orleans	2.85	2.85	2.85	2.85	1.25	1.35
Los Angeles	2.50		2.50		1.75	
Atlanta	*1.75*†	1.75†	*1.75*†	1.75†	*1.00*†	1.32†
Detroit	1.62	2@2.25	1.62	2@2.25	2.02½	2.00
Baltimore	1.40	1.40†	1.60	1.60†	0.70†	0.70*†
Montreal	1.25†	1.25†	1.50†	1.50†	1.25†	1.25†
Birmingham (Crushed slag used instead of gravel)					1.30†	1.25†
Philadelphia	2.00†	1.70	2.00†	1.75	1.50†	1.65
Kansas City		2.00		2.00	0.66*†0	66*†

New York—Grits, $1.75 per cu. yd.; ready mixed, $2.00
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
* At pit.
† Per ton.

CRUSHED STONE—Price for cargo or carload lots f.o.b. city unless otherwise, is as follows, per cu.yd.:

	1½ In. Dec. 6	1½ In. One Year Ago	¾ In. Dec. 6	¾ In. One Year Ago
New York	$1.65	$1.65	$1.75	$1.75
Chicago	2.00	2.25	2.00	2.25
St. Louis	*1.70*	2.10	1.90	2.20
Dallas	2.83	1.65	2.83	1.65
San Francisco	2.15	2.15	2.15	2.15
Boston	1.55*	1.65	1.55*	1.65
Minneapolis	1.85	2.00	2.00	2.25
Kansas City	1.50	2.40	1.50	2.40
Denver	3.50	3.50	3.50	3.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	*1.90**	2.10*	*1.90**	2.10*
Cincinnati	1.65	1.95*	1.65	1.95*
Los Angeles *delivered*	2.75		3.00	
Detroit	1.75	1.90@2.00*	1.75	1.90@2.00*
Baltimore	2.50	1.70*	2.55	1.60*
Montreal	1.80*	1.80*	1.90*	1.90*
Philadelphia	2.00*	1.75*	2.00*	1.60*
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.00*	3.25*	3.00*

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants:

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.40	1.40	2.00	1.40
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa	0.85	0.90	2.50	
Birmingham, Ala	1.05	1.15	2.05	0.80
Buffalo, N. Y., and Erie, Pa	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.45	1.45	1.45	1.25
Eastern Pa. and Northern N. J	1.20	1.20	2.50	1.20
Western Pennsylvania	1.25	1.25	2.00	1.25
Longdale and Glen Wilton, Va	1.25	1.25	2.50	1.00
Toledo, Ohio	1.50	1.50	1.50	1.50

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$13.10	$3.75*	$3.00@3.25*
Chicago	20.00	20.60	1.50†	1.50†
St. Louis	23.20	20.00	18.75‡	18.75‡
Boston	*22.50*	*16.50*	4.50*	2.95*
Dallas	23.50	...	...	*1.85*†
Cincinnati	16.80	14.30	...	...
San Francisco	22.00	...	...	2.10†
Minneapolis	25.50	21.00 (white)	1.70†	1.50†
Denver	24.00	...	...	2.70†
Detroit	20.00	19.00	18.00‡	*18.00*‡
Seattle, *paper sacks*	24.00	...	2.80†	...
Los Angeles	...	18.50	...	2.00†
Baltimore	24.25	17.85	2.55	...
Montreal	...	21.00	...	9.50‡
Atlanta	*23.00*	*14.00*	*2.25*†	*1.50*†
New Orleans	...	...	2.40†	1.85†
Philadelphia	23.00	16.00	1.93*	1.24†
Kansas City	...	18.50	2.59*	2.45*
Birmingham	14.50	13.75	2.00†	1.80†

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton—Refund of 10c. per bbl. Minneapolis quotes brown common lump lime; Kelly Is white is $1.80. Sheboygan $1.70. New York quotes hydrated lime "on cars" in paper sacks; lump lime "alongside dealers docks" or "on cars."

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b. exclusive of bags:

	Dec. 6	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.50	1.50
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.80	
St. Louis (Carney)	*2.25*	1.75
Birmingham (Magnolia) pozzolan cement	2.10	...

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	Dec. 6	One Month Ago	One Year Ago
New York, del. by truck	$2.55@2.65	$2.70@2.80	$2.60
New York, alongside dock to dealers	*2.15*	2.30	2.30
Jersey City	*2.33*	2.48	2.48
Boston	2.92	2.90	2.85
Chicago	*2.10*	2.20	2.20
Pittsburgh	*2.19*	2.24	2.24
Cleveland	*2.41*	2.46	2.46
Detroit	*2.37*	2.48	2.47
Indianapolis	*2.31*	2.41	2.41
Toledo	2.48	2.48	2.48
Milwaukee	*2.25*	2.37	2.37
Duluth	*2.19*	2.25	2.14
Peoria	*2.27*	2.41	2.39
Cedar Rapids	*2.38*	2.48	2.45
Davenport	*2.33*	2.43	2.43
St. Louis	*2.35*	2.45	2.35
San Francisco	2.61	2.61	2.71
New Orleans	*2.80*	2.90	3.30
Minneapolis	*2.42*	2.50	2.39
Denver	2.84	2.84	2.85
Seattle	2.90	2.90	2.90
Dallas	2.05	2.05	2.25
Atlanta	*2.35*	2.60	2.54
Cincinnati	*2.41*	2.54	2.51
Los Angeles	3.16	3.16	...
Baltimore	*2.61*	2.65	2.90
Birmingham	2.80	2.80	2.40
Kansas City	2.27	...	2.45
Montreal	2.25	2.25	2.88
Philadelphia	*2.81*	2.96	2.51
St. Paul	*2.42*	2.50	2.39

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind	$1.85	Hudson, N. Y.	$2.05
Universal, Pa	*1.95*	Leeds, Ala	*1.95*
Steelton, Minn	*2.00*	Hannibal, Mo	*1.95*
Fordwick, Va	*2.05*	Lehigh Valley District	*1.95*
Mitchell, Ind	*1.95*	Wyandotte, Mich	*2.10*
Iola, Kan	*1.95*	Alpena, Mich	*2.00*
Mason City, Ia	*2.00*	Richard City, Tenn	*2.05*
La Salle, Ill	*1.95*	Kingsport, Tenn	*2.05*

TRIANGLE MESH—Price per 100 sq. ft in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago Mill	Warehouse: New York	Warehouse: St. Louis	Warehouse: Dallas	Warehouse: San Francisco
032	22	$0 95	$1 02	$1 24	$1 04	$1 12	$1 21
049	28	1 20	1 30	1 58	1 32	1 38	1 52
068	35	1 47	1 59	1 94	1 62	1 67	1 87
093	45	1 89	2 04	2 50	2 08	2 00	2 42
126	57	2 34	2 53	3 09	2 59	2 55	2 99
153	68	2 79	3 02	3 60	3 08	3 15	.....
180	78	3 20	3 47	5 22	3 64	3 47	.....
245	103	4 22	4 57	4 60	4 66	4 58	.....
287	119	4 88	5 28	6 44	5 39	5 26	6 00
336	138	5 66	6 13	7 39	6 25	6 11	.....
395	160	6 56	7 10	8 67	7 25	7 12	.....
		PAVING					
036P	17	$0 72	$0 78	$0 95	$0 79	$0 76	.....
053P	24	1 02	1 10	1 35	1 12	1 07	.....
072P	31	1 29	1 40	1 71	1 42	1 39	.....
097P	40	1 66	1 80	2 20	1 83	1 90	.....
049R	24	.....	1 10	.....	1 12	1 07	.....
067R	31	.....	1 40	.....	1 42	1 39	.....
089R	40	.....	1 80	.....	1 83	1 90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq. ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Gage	Weight	*New York	Chicago	St. Louis	San Francisco	Dallas
27Dia.	2.3	$22 00	$21 25	$20 72	$20 00	$25 50
26 "	2.5	22 00	22 50	22 39	19.11	27 58
25 "	3.0	22 00	25 25	24 93	.....	30 71
24 "	3 4	24 00	27 25	27 10	24 09	33 16
22 "	4 33	27.00	31 75	32 27	.....	35 10

*Price to contractors at warehouse or delivered on job in Manhattan, Bronx or Brooklyn.

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham Mill	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
¼ and larger..	$2 40	$2.70	$3 54	$3 20	$3.35	$3 38	$3 65
⅜.....	2 45	2 80	3 59	3 25	3 50	3 43	3 75
½.....	2 50	2 90	3 64	3 30	3 55	3 48	3 85
⅝.....	2 65	2 95	3 69	3 45	3 75	3 63	4 05
¾.....	2 90	3 00	4 04	3 70	4 35	3 78	4 65

Includes 15c charge for cutting to lengths of 2 ft. and over. Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
½ and larger	$2 30	$3.05	$3 08	½.....	$2 70	$3 30	$3 30
⅝ in.....	2 40	3 10	3 13	¼.....	3 30	3 50	3 48
¾.....	2 50	3.15	3 18	.....	.....	.....	.....

BRICK—Contractors price per 1,000 in carpo or carload lots is as follows:

	Common: Dec. 6	Common: One Month Ago	Common: One Year Ago	Paving Block: 3-inch*	Paving Block: 4-inch*
New York (del.).....	$22.55	$22.55–23.65	$18.00@18.55	$46.50	$54 00
New York (at dock)...	19.00	19@20	15@15.50	.....	.....
Chicago	11 00	11 00	11.00	34 00	42 00
St. Louis, salmon.....	16@18	16@18	15 00	38@40	40@42.50
Denver, salmon	12.00	12 00	12 00	.....	.....
Dallas.....	11.60	11 00	9 90	33.00	.....
San Francisco	15 50	15 00	15 50	.....	.....
Los Angeles	14 56	15 50	.....	(not used)	
Boston (del.)	22 00	23 00	22 00	48.25	56 00
Minneapolis (del.)....	16@18	16@18	18@19	.....	.....
Kansas City.....	16 50	.....	14 50	(no market)	
Seattle	15 00	15 00	14 00	55 00	.....
Cincinnati	18@19	18@19	17 00	45.00	50 00
Montreal	16 50	16 50	16 00	100.00‡	68 00
Detroit (del.).....	18 25	18 25	17.00	38 50	41.50
Baltimore (del.).....	21.00	21 00	20.00	40.00	45.00
Atlanta	11 00	11 00	11 50	40.00	45 00
New Orleans.....	18 75	18 75	15 75	.....	.....
Birmingham	12.50	14.00	12.50@14.00	12.50	.....
Philadelphia	22 00	22 00	20@28	38.00	46.00
Pittsburgh (del.).....	16.00	16 00	16.00	.....	.....
Cleveland	16.00	16 00	16 00	.....	.....

*For paving blocks 3½x8½x3 and 3½x8½x4 respectively. †F.o.b ‡Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Dec. 6 on Trucks*	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory*
4x12x12..	$0 1179	$0 123	$0 0724	$0.125	$0 089	$0.108	.....
6x12x12...	.1769	.1844	.0996	.....	.122	.156	.....
8x12x12...	.2211	.2305	.1358	.215	.162	244	$0 1968
10x12x12...	.....	.....	.1695	.....	.186	.....	2442
12x12x12...	.....	.....	.1937	.....	.232	.....	3175

* 5 per. off for cash.

	4x12x12	8x12x12	12x12x12
Boston.....	$0 13	$0.24	.....
Minneapolis (f.o.b. cars).....	07	.12	$0.20
Minneapolis (delivered).....	.075*	.13	.21
Cincinnati.....	.0815	.153	.....
Kansas City.....	.0965	.12	.....
Denver.....	065	123	.188
Seattle (delivered)	11	.25	.36
Los Angeles	.0931	.1686	.....
New Orleans.....	.12	.23	.....
Detroit (delivered).....	.1145	.2147	.27
Montreal.....	.115	.225	.30
Baltimore.....	.125	.27	.....
Atlanta.....	.10	.167	.....
Dallas.....	.11	.20	.285
Birmingham.....	.11	.18	.....
Pittsburgh (delivered).....	.068	.128	.179
Cleveland.....	.08	.164	.....

San Francisco and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	Dallas	Warehouse: St. Louis	Warehouse: Chicago	Warehouse: San Francisco
Beams, 3 to 15 in.....	$2 50	$3 00	$3 64	$4 20	$3 45	$3.30	$3.60
Channels, 3 to 15 in.....	2 50	3 00	3 64	4 20	3 45	3.30	3.60
Angles, 3 to 16 in., ¼ in. thick.....	2 50	3 00	3 64	4 20	3 45	3.30	3.60
Tees, 3 in. and larger..	2 50	3 00	3 64	4 20	3 45	3.30	3.60
Plates, ¼ in. thick and heavier.....	2 50	3 00	3 64	4 30	3 45	3.30	3.60

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York, Dec. 6	Warehouse: New York, One Yr. Ago	Warehouse: Chicago	Warehouse: St. Louis	Warehouse: San Francisco	Warehouse: Dallas
½ in. and larger	$2.65@2.85	$4.40	$3.85	$3.75	$4.15	$5.00	$4 90

CONE HEAD BOILER

½ in. and larger	$2.85@3.00	$4.50	$3 95	$3 85	$4.35	$5 20	$5.00
⅝ and ¾.....	3.00@3.15	4.66	4.11	4.00	4.70@4.95	5 35	5.15
⅞ and 1.....	3.25@3.40	4.90	4 35	4.25	4.9@5.150	5 60	5.40

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire.....	$3.00	$3.80	$4.25	$4.55	$3.34	$4 95
Cut	.....	4.45	5.25	5.75	3.64	5 00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
⅜.....	$9.85	$7.65	$8.00
½.....	7.80	6.30	7.75
⅝.....	7.75	6.15	7.70

Pittsburgh base in lots of 200 kegs or more, $3.50

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $4.31 per roll in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $5.75 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in l) f.o.b. Philadelphia, l.c.l., $5.80 per square.

ROOFING MATERIALS—Prices f.o.b. New York, in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton.....	$67.50
Tar pitch (in 400-lb. bbl.), per 100 lb.....	1.62½
Asphalt roofing (in barrels), per ton, f.o.b. plant*.....	38.75
Asphalt felt (light), per ton, f.o.b. plant*.....	75.00
Asphalt felt (heavy), per ton, f.o.b. plant*.....	75.00

* Delivered in Metropolitan Dist., $3.00 additional.

WINDOW GLASS—Double strength, box list, united inches, 34, "AA" grade, at discount of 85 per cent from standard lists, f.o.b. New York; "A" grade less 84 per cent and "B" grade, 87 per cent.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10.....	$3.00	$4.45	$4.00	$5.00	$4.59
No. 12.....	3.10	4.50	4.05	5.05	4.64
No. 14.....	3.20	4.55	4.10	5.10	4.69
No. 16.....	3.40	4.65	4.20	5.20	4.79
Black					
*Nos. 18 and 20.....	3.60@3.70	5.00	4.70	5.60	4.95
*Nos. 22 and 24.....	3.65@3.75	5.05	4.70	5.65	5.00
*No. 26.....	3.70@3.80	5.10	4.75	5.70	5.05
*No. 28.....	3.75@3.85	5.20	4.85	5.80	5.15
Galvanized					
No. 10.....	3.80@4.00	5.35	4.85	5.50	5.15
No. 12.....	3.95@4.10	5.45	4.95	5.60	5.25
No. 14.....	3.95@4.10	5.45	4.95	5.75	5.25
Nos. 17 to 21.....	4.25@4.40	5.75	5.24	5.90	5.55
Nos. 22 and 24.....	4.40@4.55	5.90	5.40	6.05	5.70
*Nos. 25 and 26.....	4.55@4.70	6.05	5.55	6.20	5.85
*No. 28.....	4.85@5.00	6.35	5.85	6.50	6.15

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: Dec. 6	New York: One Year Ago	Chicago: Dec. 6	Chicago: One Year Ago
Raw in barrels (5 bbl. lots).....	$0.95	$0.90	$0.94	$0.95

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Dec. 6	1 Yr. Ago	Dec. 6	1 Yr. Ago
Red	14.00	13.25	15.50	14.75
White	14.00	13.25	14.00	13.25

LUMBER

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$40.00	$41.00	$42.00	$45.00
3x6 and 8	40.00	41.00	42.00	45.00
4x4-6 and 8	40.00	41.00	42.00	45.00
3x10 and 12	40.00	41.00	42.00	45.00
3x14	42.00	42.00	44.00	46.00
4x10 and 12	40.00	41.00	42.00	45.00
4x14	42.00	42.00	44.00	46.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$42.00	$44.00	$46.00
6x14	47.00	49.00	51.00
8x10	42.00	44.00	46.00
8x14	47.00	49.00	51.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	*$42.00*	*$43.00*	*$42.50*	*$44.50*
3x10 to 10x10	*47.00*	*48.00*	*48.50*	*50.50*
3x12 to 12x12	*52.00*	*53.00*	*55.50*	*57.50*
3x14 to 14x14	*57.00*	*58.00*	*61.50*	*63.50*
3x16 to 16x16	*62.00*	*63.00*	*69.50*	*71.50*
3x18 to 18x18	*70.00*	*71.00*	*79.50*	*81.50*
4x20 to 20x20	.....	.....	*89.50*	*91.50*

*Wholesale price to dealers; to contractors, delivered from lighters or cars to job, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12 x 12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under.

Other Cities

	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Sp.uce	P.	Fir*
Boston	*$65.00*	$100.00	*$60.00*	*$58.00*	*$83.00*	$125.00
Seattle	.....	29.50	.....	.....	.....	29.50
New Orleans	28.00	.....	.....	.....	31.00	.....
Baltimore	33.50	53.00	53.00	60.00	38.00	53.00
Cincinnati	40.00	75.00	75.00	90.00	44.00	80.00
Montreal	50.00	.....	.....	.....	.....	65.00
Los Angeles	.....	50.00	.....	.....	.....	51.00
Denver	.....	*40.75*	40.75	40.75	.....	*41.75*
Minneapolis	42.00	44.75	41.50	.....	44.00	45.75
Atlanta	*38.00*	.....	.....	.....	*37.00*	.....
Dallas	50.00	.....	.....	.....	54.75	.....
Kansas City	43.25	.....	.....	.....	53.25	.....
Birmingham	30@35	.....	.....	.....	40@45	.....
Philadelphia	*60.00*	59.00	59.00	77.00	*69.00*	70.00
Detroit	43.75	49.75	.....	.....	56.75	52.25
St. Louis	*42.00*	.....	.....	.....	*54.00*	.....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	*$50.00*	$80.00	*$50.00*	*$60.00*	$100.00
Seattle	.....	25.00	.....	.....	29.00
New Orleans	72.00	.....	.....	31.00	.....
Baltimore	60.00	44.00	44.00	34.00	50.00
Cincinnati	76.00	81.00	76.00	35.00	90.00
Montreal	56.00	50.00	45.00	45.00	45.00
Los Angeles	.....	45.00	.....	.....	.....
Denver	.....	*31.25*	*31.25*	.....	*33.25*
Minneapolis	42.00	39.75	39.50	38.25	36.25
Atlanta	*17.50*	.....	.....	*27.00*	.....
Dallas	50.00	.....	.....	53.33	.....
Kansas City	.....	46.00	.....	36.00	.....
Birmingham	24@28	.....	.....	32@36	.....
Philadelphia	*31.00*	63.00	*45.00*	*50.00*	65.00
Detroit	49.00	38.00	.....	41.50	39.50
St. Louis	*38.00*	.....	.....	*27.00*	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M.ft. to contractors.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers price to contractors on large projects.

St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M.ft. additional.

Seattle—Price to contractors, delivered.

Dallas—Wholesale to contractors, $10 per M.ft. additional.

*Douglas fir.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

MISCELLANEOUS

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Dec. 6	One Month Ago	One Year Ago
$2.65	$2.65	$2.50

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern New York and East of Missouri River	Territory
Hercules red strand, all constructions	20%	
Patent flattened strand, special steel wire rope	20%	
Patent flattened strand, iron rope	5%	
Plow steel round strand rope	35%	
Special steel round strand rope	30%	
Cast steel round strand rope	20%	
Round strand iron and iron tiller	5%	
Galvanized steel rigging and guy rope	7½%	
Galvanized iron rigging and guy rope	+12½%	

California, Oregon, Nevada and Washington Discount: 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arizona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft.; ⅝-in., 6; ¾-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0.15½@0.17½	New Orleans	$0.17½
New York	.17	Los Angeles	.20
Chicago	.18	Seattle	.18
Minneapolis	.17½	St. Louis	.19½
San Francisco	.16	Montreal	.22
Atlanta	.25	Detroit	.20
Denver	*15½@16½*	Baltimore	.18
Cincinnati	.19	Kansas City	.20½
Dallas	.21	Birmingham	.20½
Philadelphia	.17		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.25	.27
Kansas City	.2225	.2475
Seattle	.165	.19
Chicago	.22	.25
Minneapolis	.1917	.2123
St. Louis	.2225	.2475
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1975	.2225
Atlanta	.23	.2550
Baltimore	.22	.23
Cincinnati	.225	.25
Montreal	.195	.235
Birmingham, *delivered*	.16	.17
New Orleans	.195	.22
San Francisco	.1625	.1925
Philadelphia	.215	.24

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f. o. b. New York:

Sulphate of aluminum, in bags, per 100 lb.	$1.40@1.50
Sulphate of copper, in bbl., per 100 lb.	5.00
Soda ash, 58%, in bags, per 100 lb.	*1.25@1.45*
Chlorine, liquid, cylinders, 100 lb., per lb.	.08½@.09
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	*1.75*

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.58	Kansas City	.735
Boston	.365	New Orleans	.67
Buffalo	.265	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.34†
Cincinnati	.29	Philadelphia	.32
Cleveland	.215	St. Louis	.43
Denver	1.27*	St. Paul	.60

* Minimum carload, 40,000 lb.

† Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.